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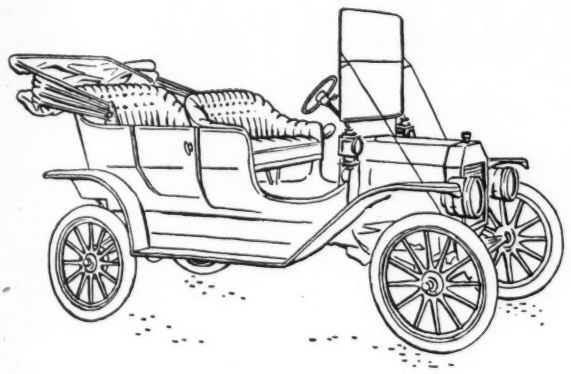

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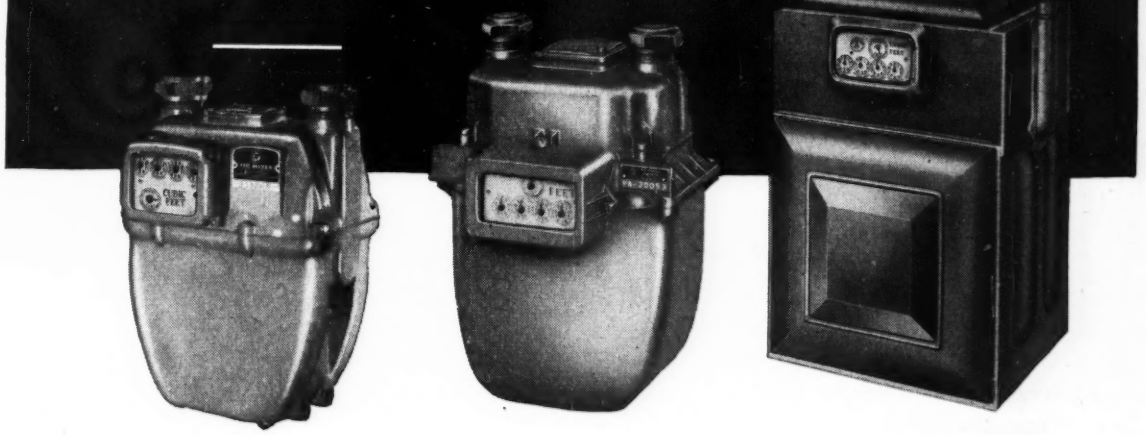

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GAS

29th Year of Publication

APRIL 1953 • VOLUME XXIX • NUMBER 4

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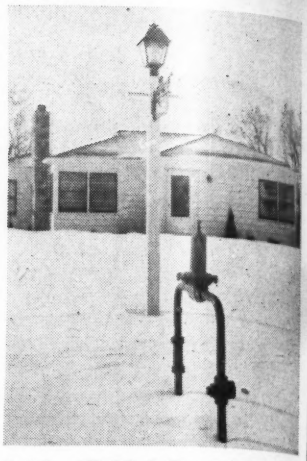

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Regulators such as this enable Minneapolis to serve customers off a 75-psi line *(see p. 48).*

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Thermally Thinking

SPOT NEWS AND COMMENT ON GAS INDUSTRY AFFAIRS

Highlighting the News

Gas househeating periled

In Pennsylvania, gas utilities are bitterly denouncing a coal interest-sponsored bill to ban underground storage of gas within 4000 ft of working coal mines. The motivation is supposedly to prevent stray gas from entering mines and causing explosions. Equitable and Peoples, both of Pittsburgh, charge it would virtually eliminate all their storage pools. Both have slapped freezes on househeating installations. Says Peoples' president: "Why not bar coal workings near gas storage areas?"

Cooperative program ready

AGA and GAMA have been swinging around the country, laying out before small groups of executives the "Action Program for Gas Industry Development." The joint plan to inject life into sagging gas sales is ambitious, and could usher in a new growth era—if everyone buys it. Both agencies are praying for some deep introspection by the many who ordinarily say, "That's fine, but it doesn't apply to me . . ."

Canadian situation perks up

Trans-Canada has just signed purchase contracts for its proposed Alberta-to-eastern-Canada line. Northwest Natural is also studying the eastern markets, with a dip into the north central U.S. Alberta is becoming uneasy; Saskatchewan says it is ready to export gas—on certain conditions.

States busy with gas regulation

Legislatures and commissions of dozens of states from coast to coast have their eyes on gas, for one reason or a dozen. Chief interest lies in taxation: Texas is up to bat again with some new bills, New Mexico has a severance tax bill, Oklahoma's houses have passed a 1-cent-per-Mcf production tax, but Arkansas has rejected a severance tax hike. Colorado is still discussing the best methods of levying taxes, and is also debating a new underground storage proposal. Louisiana is thinking (again) about cutting off exports. New Jersey's commission has just promulgated safety rules and regulations. California is studying new proposals on utilization practices. These are but a few of the many activities throughout the nation.

An Eye on the Capital

"Standby" dangers

No sooner had all of the onerous restrictions of the Office of Price Stabilization been taken off natural gas and other commodities at all levels of distribution than the executives of natural gas companies started worrying about the dangers inherent in the broad language of the so-called "standby controls" legislation being pushed by Sen. Homer Capehart (R.-Ind.), chairman of the Senate Committee on Banking and Currency.

Senator Capehart describes his proposal to put an automatic freeze on all wages, salaries and prices at all levels, in case of a general war, as "merely economic penecillin." Opponents—including most natural gas leaders—said that controls medicine is bad medicine, whether there is an emergency or not. They say that the natural workings of the law of supply and demand, if given a chance, would not be unjust, come war or come peace.

This is revolutionary talk, in a town in which the administrators hitherto have thought without doubt that there was never anything wrong in the economy that controls couldn't cure. But business groups are going down the line for "no controls." It is ironic that Senator Capehart, a manufacturer before he became a politician and one of the Republicans who used to cry out for a "free market," is now a champion of "standby controls."

What scares the utilities about the Capehart control bill is that it has such broad language. Under this bill (S. 1081), which undoubtedly will be revised and perhaps will never be passed by the Senate and the House of Representatives, all kinds of public utilities would find their rates once more subject to Presidential whim. Absolutely no provision for exempting regulated utility rates, such as is contained in the present Defense Production Act, as amended (and due to expire June 30), is included in the Capehart bill. The legislation merely gives a blanket, untrammeled authority to the President to make the exemptions his judgment finds might be practical or necessary.

Rep. Jesse Wolcott (R.-Mich.), chairman of the House Committee on Banking and Currency, who is strongly against any kind of standby control legislation (except grant of authority allowing the armed services first call on vital minerals, metals and materials), may never let the Capehart bill get through his committee. If so, utilities executives will be breathing easier and businessmen generally will be quite pleased.

Controls that don't control

A good example of how controls—of almost any kind you can name—do not control was pointed up here by a

Thermally Thinking

report issued by the U. S. Bureau of Labor Statistics, showing that during the two years of "wage control," the average pay of the nation's 16.5 million factory workers went up 18 cents an hour, or 11.5%. In the same period, the cost of living went up only about 5%.

These figures make it apparent why the new majority on Capitol Hill was determined to kill controls. They see no reason for perpetuating a fiction begun by their political enemies—namely, that any number of bureaucrats by fiat can control economic movement of prices, wages, or anything else.

Gas and electric utilities leaders took a dim view, too, of the apparent attempt of some federal administrators to give the Federal Power Commission the authority to rule on defense plant tax certificates (fast tax write-offs).

Spokesmen for the utilities, appearing at a hearing in mid-March, opposed any FPC regulation dealing with such certificates for either rate-making or accounting purposes. They fear that such a rule might confuse and complicate rate-making on the state level.

McCarthy and the FPC

Don't hold your breath until the Federal Power Commission re-opens hearings in the application of Texas-Ohio Gas Co. of Houston, for authority to construct a 1406-mile pipeline and to import natural gas from Mexico.

Sen. William McClellan (D.-Ark.) said that there appeared to be "major discrepancies" in testimony involving the company's case, after testimony had been given in closed sessions to the Senate Permanent Subcommittee on Investigations, headed by Sen. Joseph R. McCarthy (R.-Wis.). Senator McClellan indicated that the charges involve some "big names" of the discredited administration of Harry S. Truman, but the names were not big enough to get reporters excited.

Senator McCarthy has indicated he is not above exerting pressure on the commission. He has made a veiled threat of an investigation of "Communists" in FPC, but he seems to be rather late in this respect, since the last man suspected of being a Communist (Leland Olds) in the commission has long since departed it.

If there are any Communists in FPC, they are far down the ladder from the seats of power, and, in fact, Senator McCarthy's reference to the possibility that there are *any* Commies in the agency was the first time anyone in Washington ever thought of it.

The FPC members profess not to be very excited about the possibilities of Senators McCarthy and McClellan causing them much pain over the Texas-Ohio decision. Exceptions had been filed to the preliminary decision by Texas-Ohio, Reserve Natural Gas Corp., and the public utilities commission of Ohio, but the FPC said that Texas-Ohio "on the whole record has not made a showing that it has an adequate supply of gas to warrant the issuance of a certificate."

Company officials indicate they will pursue the matter further—as they undoubtedly are doing, or trying to do, through the Senate—but their chances for this year are not very promising.

Robertson on inside track

Insiders here give Jeff Robertson, chairman of the Kansas Corporation Commission, the best chance to be named new chairman of the Federal Power Commission by President Dwight D. Eisenhower, but they aren't counting Willard W. Gatchell, now assistant general counsel of FPC, completely out of the race.

Mr. Robertson is backed by U. S. Sen. Frank Carlson, a close friend and pre-convention backer of the President. However, Senator Carlson's recommendation of Leslie Roberts, former Kansas City public relations man, to be chairman of the Republican National Committee, with the resultant embarrassment to the President over disclosures of a fee paid to the new Republican chairman in the sale of a Kansas hospital to the state, has put him temporarily under a cloud.

Mr. Gatchell, on the other hand, is said to have the backing of New York Governor Thomas E. Dewey, a power in this administration. The FPC assistant counsel is said to be strongly in favor of letting, if not helping, New York State to develop the St. Lawrence power and seaway project with Canada, something very near and dear to Governor Dewey's heart.

True or false?

What with an overwhelming number of gas rate increase requests still logjamming in FPC's dockets, the question recently raised over the validity of Panhandle Eastern Pipe Line Co.'s reported 1952 earnings is liable to be repeated with increasing frequency among other companies.

Wall Street is said to be wondering whether the $5-per-share reported by the company will prove to be actual earnings. Panhandle sought a $21 million rate boost in 1951, and it went into effect under bond on Feb. 20, 1952, pending final disposition. FPC has still not rendered a decision, so it may be months before it is known whether the figure will stand. Commission staff recommendations are for a greatly reduced increment, so it's dubious that they will.

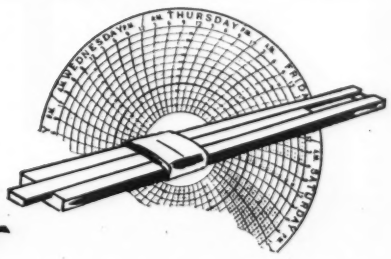
No shortcuts allowed

Speaking of logjams, an FPC action which the court interpreted as a dodge to throw out a case before it was heard and thus lighten the work load was recently declared to be "in error" by the Third Circuit Court of Appeals.

The case involved Mississippi River Fuel Corp., natural gas supplier for St. Louis and neighboring sectors. On April 30, 1952, Mississippi filed for a rate increase to become effective June 1. On May 29, FPC rejected the petition without hearings on the ground that about one-third of the increase was based upon an anticipated increase in the cost of gas which Mississippi buys from a supplier, United Gas Pipe Line Co. While admitting that the remaining two-thirds bore no relation to the possibility, FPC said the case was not "so constructed" as to enable the commission to deal with its components separately. Therefore, the proposal was

Continued on page 70

Technical Trends



• By GUY CORFIELD

Oxygen recorders

Instruments that will automatically measure and record the amount of oxygen in a gas stream are of interest to the gas industry for checking the amount of air that may be in gas, either from entry in natural gas gathering system, or through plant processes, or by deliberate mixing to stabilize heating value; also for combustion control in furnaces and boilers; also to check and adjust the analysis of special "atmospheres" for metal heat treating, inert gas "blanketing," or purging, where the presence or absence of oxygen, or its control within close limits, is highly important. Research and development in this field, and the instruments that have become commercially available, are typical of the resourcefulness and ingenuity of the scientist and inventor. At least five different makes of instruments are on the market, depending on two general principles: combustion and magnetic susceptibility.

One design makes use of catalytic combustion wherein the gas sample is mixed with a vaporized standard liquid fuel and the mixture passed over a catalyst filament on which combustion takes place, the combustion heating the filament to a degree proportional to the oxygen content of the gas; this heating effect changes the filament's electrical resistance to unbalance an a.c. measuring bridge of which it is one leg; the unbalancing of the bridge circuit actuates a mechanism which produces the record of oxygen concentration in the gas. A second design mixes the gas sample with hydrogen supplied from a cylinder, passes the mixture through one cell, and then into a second cell where combustion takes place and hydrogen is consumed in an amount corresponding to the oxygen content of the sample; the two cells measure the thermal conductivity of the gas mixture in them and thereby detect the difference in the percentage of hydrogen, again producing electrical unbalance in a bridge circuit that in turn actuates a recording mechanism. A third design is similar to the second in general principle, but generates its own hydrogen rather than obtaining it from a cylinder.

Two other recorders take advantage of the magnetic susceptibility of oxygen, by which is meant the extent to which oxygen is attracted by a magnetic field. Generally, gases are not thought of as being attracted or repelled by a magnet, but it happens that oxygen is strongly attracted while other gases that are ordinarily associated with it in fuel gas and combustion mixtures are only slightly repelled. Therefore, the oxygen content of such gases is very closely proportional to their magnetic properties. One of these instruments includes a small, delicately suspended glass element to which movement is imparted by electromagnetic effect on oxygen in a gas sample passed through the assembly; the element carries a small mirror which, on movement, deflects a beam of light to cause electrical unbalance in a pair of photocells and thus provide an impulse, proportional to oxygen concentration in the gas sample, to operate a recording mechanism. The other instrument employs two cells, each containing sealed and equally heated platinum wire resistors, and one equipped to produce a strong electric field in the vicinity of the resistor; when a gas containing oxygen is passed across the open ends of these two cells it is drawn selectively into the one by the magnetic field, with resultant cooling of the wire resistor which unbalances a bridge circuit in which both resistors are included, to again impart an impulse to a recorder.

Sonic pump

One of the latest developments in oil well pumping is a so-called "sonic pump" in which waves produced by a mechanical oscillator travel down the tubing and develop regions of slight but rapid up and down motion. With the aid of check valves, this exerts an upward propulsion effect on the oil, in a sense converting the entire tubing string into a pump. The tubing is suspended in the well casing on a spring assembly so that it is capable of slight vertical movement and a mechanical oscillator, mounted on the top of the tubing and operated by a conventional gas engine, vibrates the tubing at subsonic rates of about 10 cycles per second. A one-way check valve is installed at each collar or joint of the tubing string, and the waves traveling down the tubing cause local vertical oscillations which open the valves on the down stroke and close them on the up stroke so that a progressive upward movement is imparted to the column of fluid. During a recent field trial in a 1000-ft well pumping rates of 500 bbl of fluid per day were maintained, and operation has been successful at depths below 5000 ft.

It is asserted that the mechanical strains on the tubing are no greater than those developed in regular sucker rod pumping, and that the wear of valves is slight because of their multiplicity. The sonic pump can reportedly be installed and operated at substantially less cost than the conventional sucker rod assembly, will be particularly applicable to crooked holes and, because of the virtual absence of rubbing motion, can readily handle sand-carrying fluids. There is even some laboratory and field indication, covered in the patent applications, that oil recovery will be augmented because of transference of a portion of the wave energy into the oil bearing formation from the bottom of the tubing.

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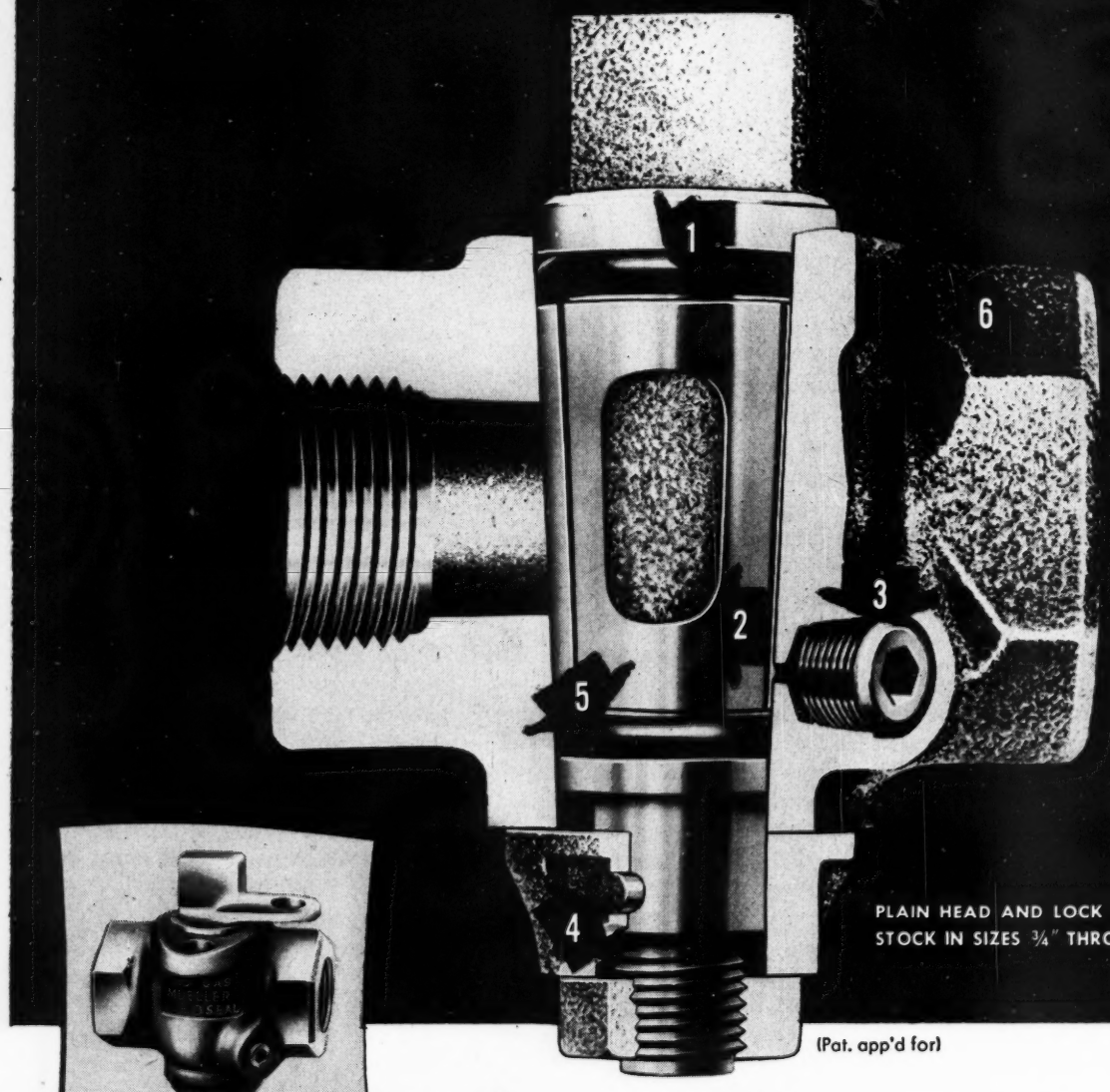

PLAIN HEAD AND LOCK WING IN STOCK IN SIZES ¾" THROUGH 2".

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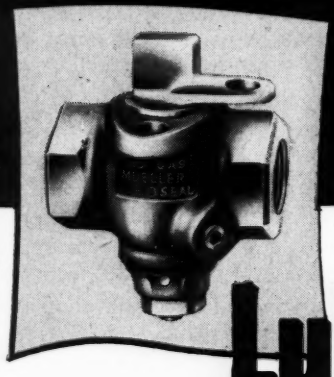

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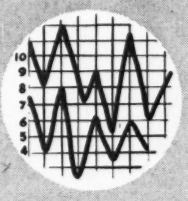


"Heart" checkup for meters

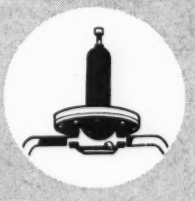
Use of the cardiograph provides records of pressure fluctuations in a meter, indicating both accuracy and performance as an efficient mechanism 38

Safety on wheels

In Compton, Calif., a converted "milk wagon" loaded with safety equipment is preventing accidents wherever gas is blowing 44

The truck that does everything

Wisconsin takes a different approach in building a leak repair "package" incorporating crane, compressor, and tool compartments 46



High pressure services

Minneapolis Gas has found a way to serve an attractive market existing along its high-pressure lines, using two regulators and an ingenious aboveground installation . . . 48

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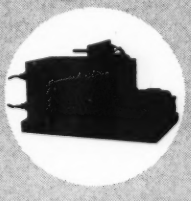
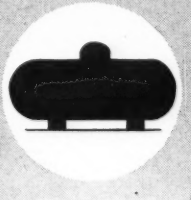
A three-part article explains the interest of government bodies and utilities in a problem of increasing severity; outlines test methods available and presents new equipment . 51



An electronic flowmeter

The National Bureau of Standards has brought out an instrument that utilizes the velocity of sound waves to measure fluid flow . . . 58



Propane-air for emergencies

Lone Star's unit, which feeds mains during natural gas shutdowns, has now been rebuilt into a convenient, truck-mounted arrangement . 60

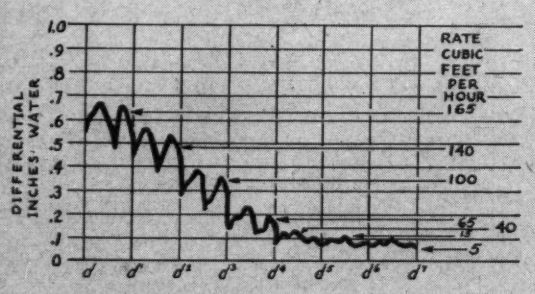


FIG. 1

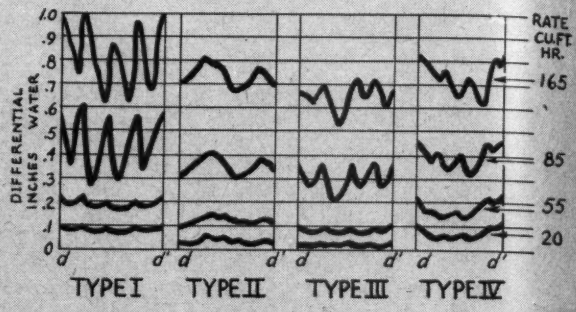
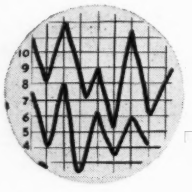


FIG. 2



Analysis with cardiographs diagnoses meter problems

By **ED GILMORE** • Lancaster Meter Parts Co., Lancaster, Ohio

CARDIOGRAPHS, a relatively new method of diagnosing meter ailments that provides a record of the pressure fluctuations within and across a meter, give an indication not only of the accuracy of the meter but also of its performance as an efficient mechanism.

The meter analyzer, which produces the cardiograph, is a very versatile laboratory instrument. A complete analysis of a meter in operation may be made with the unit and its accessories. Graphs that can be obtained show: (1) pressure fluctuations within any compartment of the meter; (2) diaphragm stroke; (3) gas passed per revolution of the meter; (4) differential pressure between any points in the flow stream through the meter.

The recorded differential across a meter furnishes a cardiograph, which indicates even a slight irregularity in the expected performance of the meter. This overall differential will be the only cardiograph used in this article. A typical graph is shown in *Fig. 1.*

The vertical coordinate indicates the differential pressure between the inlet and outlet swivels of the meter, in inches of water. The rate at which the meter was being run when the graph was made is noted at the right. This rate is in cubic feet of gas per hour. The linear distance along the horizontal line indicates the cubic feet passed. The distance from d to d^1 indicates the portion of a cubic foot passed for one revolution of the meter.

Fluctuations occur

The graph shows the fluctuations that occur in one revolution of the meter, at the rates noted. All revolutions that will be shown start with the front diaphragm at its extreme "out" stroke position. If the distance between d and d^1 or d^1 and d^2 etc. were divided into 360 equal parts, each of these parts would represent 1° of the tangent rotation, provided the meter displaced the same amount of gas for each degree turn.

Each meter design has inherent char acteristics that produce a particular car diograph pattern although a slight devi ation from this pattern may be notice able in different sizes of the same desig owing to a slight departure from th basic design of linkage ratios, diaphragm and port ratios, or other details.

This article will be limited to case that may be corrected in the meter sho and may be found in the four sma domestic iron meters in general use.

The cardiographs shown in *Fig. 2* a considered as normal for the particul type of meter. An amplified recor made by the meter analyzer at four rat of flow, is shown in order to perm more detailed study.

In all of the 10 cases used in this a ticle, the causes of the deviations fro normal were small inaccuracies whi might slip through the shop. The sam defect may not have the same degree effect on every design and size of met but it will have the same general effe

CASE 1. Poor Valve and Diaphragm Coordination

DIAGNOSIS: Fig. 3 shows an unbalanced condition in valve mechanism with greatest deviation at back diaphragm extremes, caused by improperly set back valve.

VALVE SETTING: The critical opening or closing of the measuring chambers is controlled by the valves when they are close to the center of their respective seats. Each valve is properly set when it arrives at the center of its seat when the valve crank is perpendicular to the line of travel of the valve, as shown in position A of *Fig. 4.* Such a setting puts the valve back on the center of the seat but moving in the opposite direction when the crank is turned 180° (position C). This condition must be met to balance the valve mechanism within itself and with the diaphragms. If the valves are set as described, any movement of the tangent, with or against the motion, will change the timing of the valves in respect to the extreme diaphragm strokes equally.

TREATMENT: The unbalanced condition may be corrected in all meters using slide valves, provided the valves and seats are properly made and located in respect to the crank. This correction is made by changing the length of the valve link or position of the valve wrist on some meters.

CASE 2. Poor Valve and Diaphragm Coordination

DIAGNOSIS: Fig. 5 shows inadequate and less uniform diaphragm displacement. This can be noted by the shorter length of the graph, the higher differentials at low flows, and the extended pulsations, caused by use of a less effective part of the diaphragm stroke.

DIAPHRAGM DISPLACEMENT: The diaphragm movement in all meters under discussion is controlled by an arm which swings in an arc. (Marked flag in *Fig. 6* and shown in center position). The greatest amount of displacement for the least angular movement of this arm is obtained when the movement "in" toward the center of the meter, shown as X in *Fig. 6,* is the same as the movement "out", also shown as X. The point at which the diaphragm hinges, the diaphragm construction, and the location of the diaphragm rocker shaft in respect to the flag support must also be taken into consideration in determining the most effective part of the diaphragm stroke.

The meter body determines the clearance at the end of the diaphragm stroke in many meters. These clearances are the guides in obtaining the desired stroke. Less clearance is available on the in stroke of a majority of the designs. It is not necessary nor desirable to have excess clearance, but there must always be some clearance at both ends.

The long flag arms must be attached to the flag rods at the correct angle to the flags. Where only one drive shaft is used the location of this shaft must be correct in respect to the flag support bearings.

TREATMENT: In checking for correct division of the diaphragm stroke remove the tangent from the tangent post. Place one diaphragm at its extreme in position and turn the tangent post until it is in line with the tangent link as shown at the right in *Fig. 7.* The clearance C^1 should be from one-fourth to one-half the tangent post diameter. Move the diaphragm to its out extreme position, as shown at the left. Clearance C^0 should equal or be greater than C^1.

If these conditions are not correct, unsolder the long flag

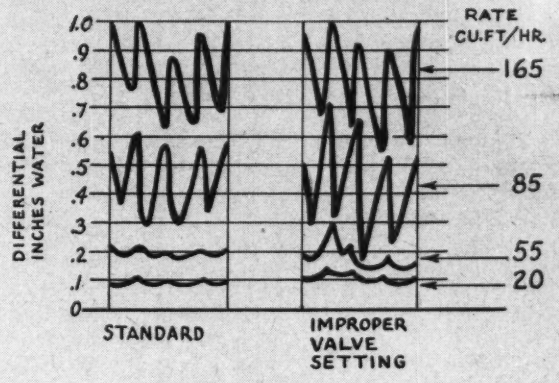


FIG.3

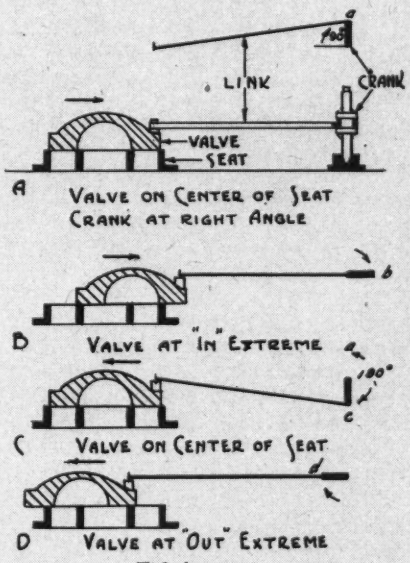


FIG.4

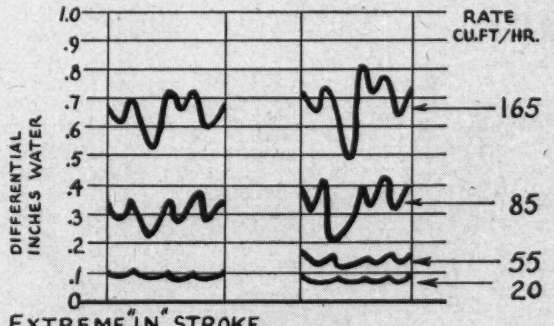


FIG.5

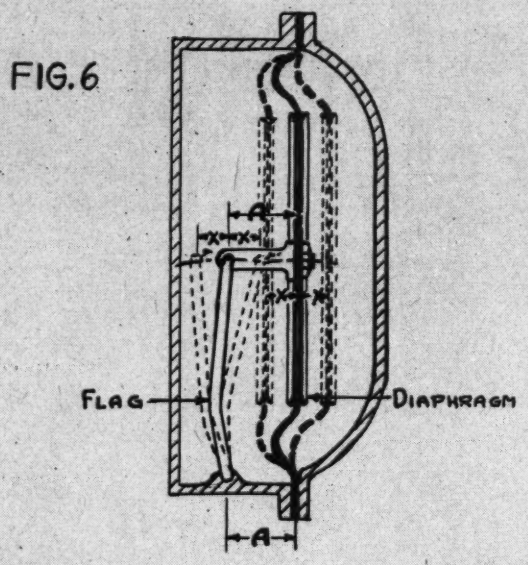


FIG. 6

DIAPHRAGM STROKE

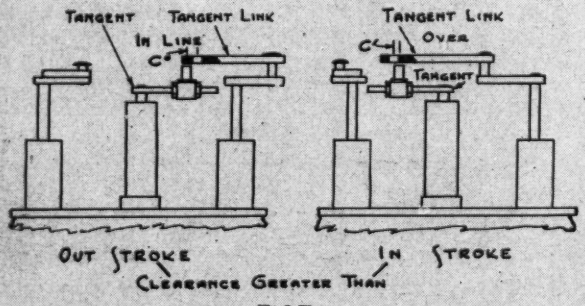


FIG. 7

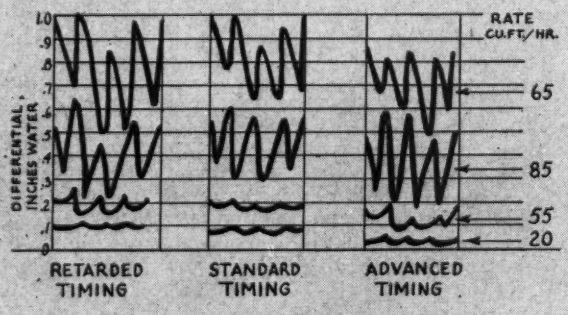


FIG. 8

arm and reset it in the proper position. If fastened by means other than solder, the desired angle may be obtained by carefully bending the long flag arm close to the hub where it is fastened to the flag rod.

If the diaphragm stroke appears to be greatly restricted at either end it is always advisable to check below the gallery, even though a small amount of clearance can be obtained at both ends by redivision. On meters not having flag rods this check must be made in the mechanism below the gallery. Such a check may be made and corrections accomplished by measurement or the use of jigs. Some old meters require compromises owing to inaccuracies in drilling. New parts are available for some types of meters that permit better alignment by providing adjustment for more accurate locating.

CASE 3. Incorrect Valve Timing

DIAGNOSIS: The longer graphs at the higher rate of flow (at left side of *Fig. 8*), combined with the more erratic pulsations and slightly higher differential indicate that the timing is retarded. The shorter graphs on the high rates of flow, on the right, combined with the lower differential at all flows indicate that the timing is advanced. The timing noted as standard in the center is slightly advanced. The position of the valve at the extreme diaphragm position for these cardiographs is shown in *Fig. 9.*

VALVE TIMING: A change in timing is accomplished by changing the angle between the tangent and the valve crank. The changing of this angle advances or retards the valve or valves so that the ports to the measuring chambers may be closed or opened earlier or later as required. Timing changes affect the proof at the higher rates of flow to a greater extent than at the lower rates. The degree of this relative effect varies with different types of meters. All meters require that the valves be advanced slightly to bring the proof at the capacity and check rates together.

An adjustable tangent length and angle, which is provided on all meters, makes it possible to satisfactorily prove a meter that has been incorrectly assembled or repaired. Each type and size of meter has a theoretically correct tangent length and angle between the tangent and crank. Any appreciable deviation from this standard indicates that some fault exists in the meter mechanism.

TREATMENT: The entire meter should be checked for trouble if other than standard timing has been necessary to get the correct proof. To check the meter for timing, move one diaphragm to one extreme position by rotating the tangent. When the tangent and tangent link are in line note the valve controlling the port to the diaphragm chamber regarding its position on the seat. *Fig. 9* shows a valve in retarded, normal, and advanced positions. If the valves were properly set, the position of either valve on the seat for the particular diaphragm extreme it controls will be the same as the other valve at its diaphragm extreme positions. All four diaphragm extreme positions should be checked to verify the valve setting. The valves should be correctly set as described in *Case 1* before any attempt is made to accurately time the meter.

Lost motion caused by wear in service tends to retard the valves. An advanced valve is necessary on higher differential rates. A valve should never be set retarded. Do not advance the valves any further than necessary to obtain

reasonable proof at all differential rates at which the meter will operate.

Most meters are supplied with a threaded angle adjustment. To change the timing on meters not so equipped, the tangent must be unsoldered or loosened from the crank shaft and moved slightly by hand and then re-attached.

CASE 4. Valve Drag

DIAGNOSIS: The slightly longer higher rate graph in *Fig. 10* showing a higher differential and more irregularity would indicate the valves were retarded because of a slight valve drag. Another indication of valve drag is that all diaphragm extremes are affected.

VALVE DRAG: Extremely bad conditions caused by foreign matter in the gas can only be corrected by properly cleaning the gas. Where excess use of odorant has been found to give trouble the concentration has been reduced. The conditions that are referred to in this paper are those that exist in a reasonably clean system but do cause sufficient trouble to be taken into consideration.

TREATMENT: If a gum or oil condition is found on the valves and seats, they should be cleaned so that no trace of oil remains in the pores or on the faces. Oil or grease should not be used where it will eventually find its way to the valve surfaces. Some of the newer materials have helped reduce this drag.

A new dry lubricant is now available that does not collect dust and rust as does oil. This material stays in place on most materials. The surface of the valve may be coated with a thin coating by finish buffing on a leather covered block that has been sprinkled with the dry lubricant. The lubricant does not ball up as does graphite and it is effective in reducing squeaks on guide wires and brackets.

CASE 5. Stuffing Box Friction

DIAGNOSIS: The nearly uniform increase in differential on the higher flow, but more pronounced at the diaphragm extremes on the low flow shown in *Fig. 11* would indicate a constant drag such as an index stuffing box.

INDEX STUFFING BOX PACKINGS: It is very difficult to pack a stuffing box with yarn or felt and have a gas-tight box without excess friction. Recent developments in materials have now made it possible to equip even the oldest type meters with a box sealed by washers, held in place with a spring, and filled with a lubricant. Such a box requires little skill to install and provides a gas-tight box with friction at a fixed minimum for the period of service of the meter.

TREATMENT: Install a lubricant-filled, spring type stuffing box. Use a stuffing box grease that will reduce the drag on the moving part rather than increase it as many of the stuffing box greases do.

CASE 6. Main Drive Shaft or Flag Rod Misalignment

DIAGNOSIS: The increased differential shown in *Fig. 12*, especially on the low flow with the major fluctuation occurring at midstroke, indicates a bind in the mechanism that is more pronounced at one point in the revolution.

BINDS IN MAIN METER MECHANISM: Binds resulting from misalignment of the main drive or flag rods affect the proof as well as the performance of the meter.

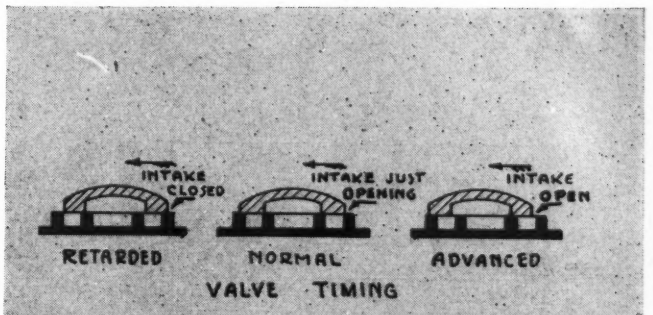


FIG.9

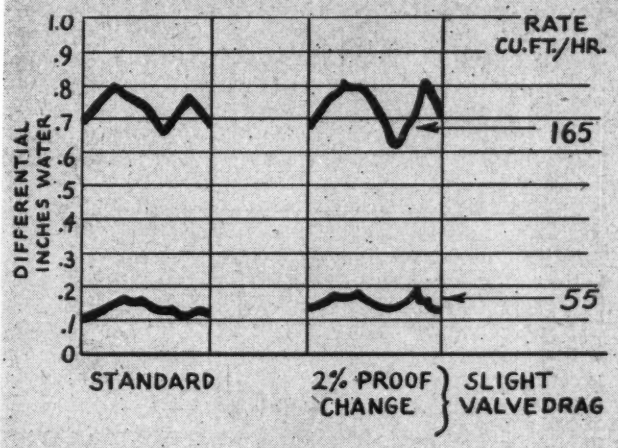


FIG.10

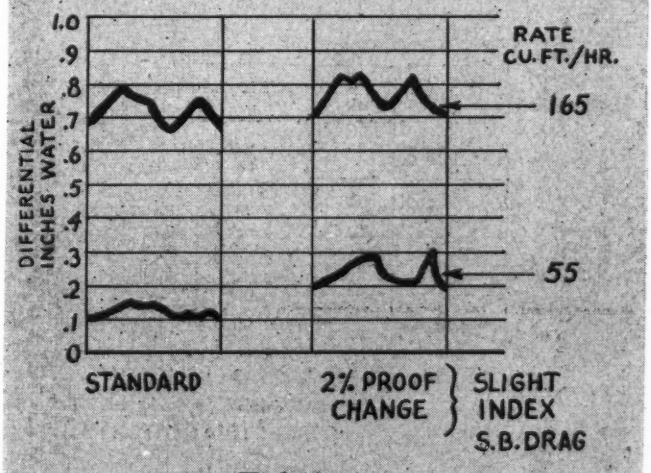


FIG.11

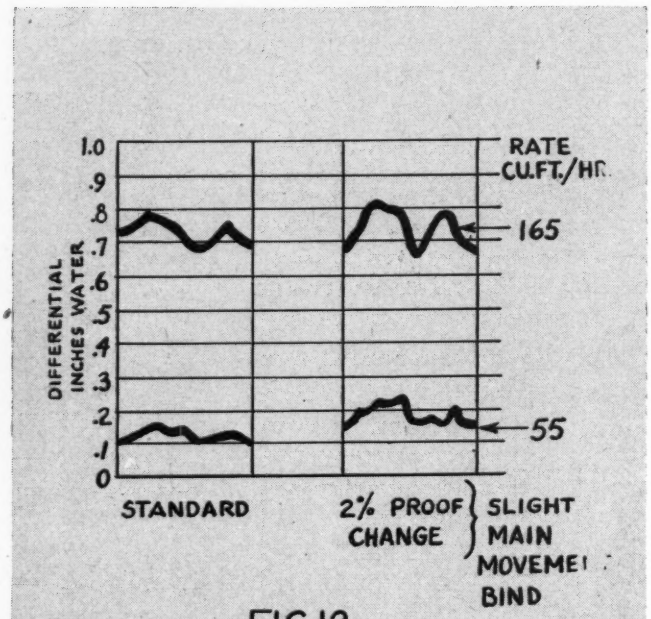


FIG.12

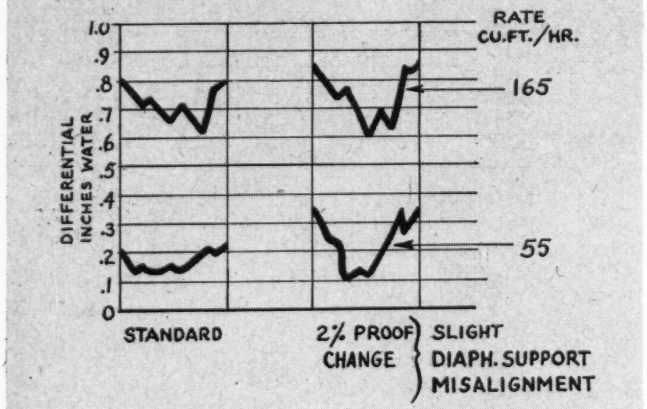


FIG.13

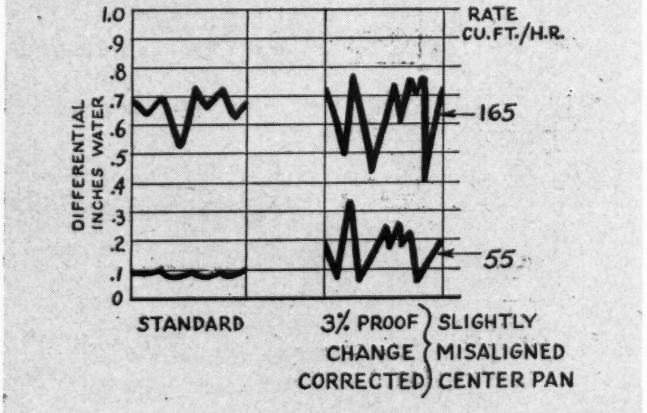


FIG.14

These binds cause excess wear and upon freeing up cause the meter to go fast.

TREATMENT: The correction for this is proper alignment and reduction of friction at bearing and sealing points. The alignment can be accomplished by the use of jigs or measurement. The use of newer parts that incorporate better bearing design and materials will be found helpful.

CASE 7. Diaphragm Supports and Flag Alignment

DIAGNOSIS: The extreme fluctuations in *Fig. 13* during the last half of the out stroke of the front diaphragm and the first half of the in stroke of the front diaphragm, indicate misalignment of the front diaphragm flag and its supports.

DIAPHRAGM SUPPORTS: The moving portion of any diaphragm must be supported so that it can move without interference or undue friction throughout its entire stroke. The bearings at the diaphragm and the flag rod ends of the flag must be parallel and so designed as to furnish adequate support for the diaphragm with a minimum of friction.

TREATMENT: Align the diaphragm support and flag support bearings so that the diaphragm disc is held perpendicular to the base of the meter at all times. Reduce friction at the bearings by using the best materials and design available. A dry lubricant can be used on these bearings to good advantage.

CASE 8. Misaligned Diaphragm Center Pans

DIAGNOSIS: The erratic cardiograph throughout the entire revolution of the meter, but even more pronounced at the back diaphragm extremes shown in *Fig. 14,* would indicate restricted movement of the center pan of the back diaphragm. The 5% longer tangent would also indicate inadequate displacement of the diaphragms.

MISALIGNED CENTER PANS: The center pan of all diaphragms used in meters that are being manufactured today displaces 80% or better of the gas being measured. This leaves a relatively small amount to be measured by the flexible material in the diaphragm. The displacement owing to the disc is positive but the effective area of the combined disc and leather can vary from many causes. The main cause is an improperly aligned center pan.

There should be a sufficient, uniform amount of leather around the center pan to permit a full stroke without pulling the leather at any position during the stroke. Diaphragms on many type meters that short stroke will be found satisfactory if the center pans are correctly aligned and the support bracket correctly located.

TREATMENT: Misaligned center pans can usually be corrected by: shifting the center pan so that the leather is evenly divided all around without wrinkles; raising the rocker shaft support; straightening the diaphragm and flag rod support. Slightly different procedure is necessary to accomplish these changes on the various types of meters. If jigs are not available to assist in these corrections the parts can be aligned by eye or measurement.

CASE 9. Diaphragms

DIAGNOSIS: The higher differential with greatest variations at the back diaphragm extreme positions shown in

Fig. 15 would indicate a heavy or unevenly wrapped back diaphragm.

DIAPHRAGMS: The main purpose of the flexible material of the diaphragm is to act as a seal. If not properly selected and assembled it can play an important part in the effective displacement of the diaphragm. The design of the diaphragm determines the thickness, stiffness, and texture of the material that must be used to obtain the best efficiency. The best diaphragms of any design are obtained by using material that is uniform in stiffness throughout the entire area that flexes.

Where diaphragms are wrapped on any ring, pan, or flange, the wrinkles under the tying medium should be kept to a minimum and those that do exist should be evenly distributed around the circumference. A uniform amount of leather sufficient to permit the diaphragm to make its complete stroke should be used between the center pan and the outside ring, flange, or pan. The diaphragms used in each meter should be matched for stiffness.

TREATMENT: Use diaphragms with center pans held firmly in place with an equal distribution of sufficient leather all around with a minimum of wrinkles evenly distributed where tied or banded. Match diaphragms for each meter for as near the same stiffness as possible.

CASE 10. Diaphragm Treatment and Conditioning

DIAGNOSIS: The cardiograph at the right in Fig. *16* was made by a meter with diaphragms containing approximately the same amount of oil, by weight, as the diaphragm leather weighed dry. The cardiograph at the left was made by the same meter after excess oil had been added to further soften the diaphragm. The proof of the meter was slowed up 2%; differential was decreased on lower flows.

If the meter with the excess oil is placed in service, the excess oil will drain out, the meter will speed up 2%, and the differential will increase owing to the diaphragm stiffening slightly. These cardiographs, although made in reverse of what happens in service, bear out the fact that excessive oiling of diaphragms is not desirable.

DIAPHRAGM TREATMENT: To check for the oil condition of a diaphragm, squeeze a fold in the leather lightly. If oil comes to the surface, there is plenty of oil to seal the diaphragm and keep it in good shape for another period. Such a diaphragm will hold the proof of the meter much better than one with excess oil.

If only a trace of oil comes to the surface when the fold is squeezed firmly, the diaphragm should be oiled. In oiling, use an oil designed for that particular weight of diaphragm and one that contains a small amount of animal or fish oil and a mold inhibitor. Do not excessively oil any diaphragm.

If the diaphragm has been completely bleached out by some solvent and no trace of oil remains, the fat liquor has also been bleached out. This is very difficult to replace and cannot be done satisfactorily by ordinary oiling processes. If such a diaphragm is re-oiled, the life expectancy of the diaphragm will be greatly reduced.

These cardiographs and the accompanying data give a very real indication that every point that might cause friction, leakage or poor coordination of the valves and diaphragms in a gas meter must be given serious consideration in design, assembly, and repair.

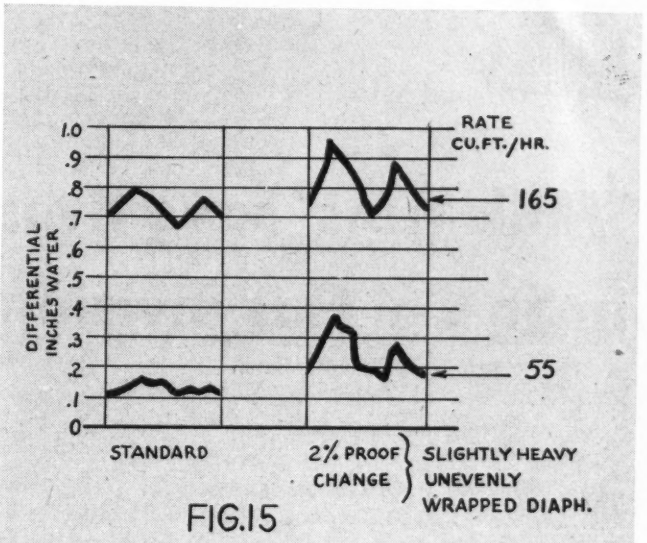


FIG.15

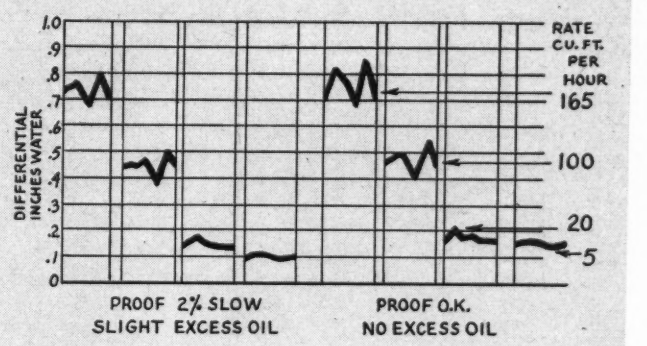
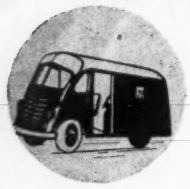
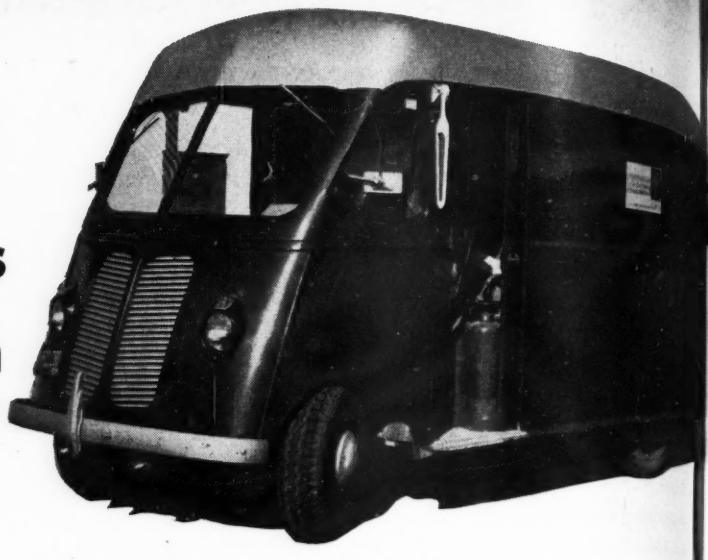


FIG.16

Mr. Gilmore is chief engineer for Lancaster Meter Parts Co. A graduate of Rensselaer Polytechnic Institute, he served as gas engineer and superintendent at various distribution properties of the Cities Service Co. His work in the positive displacement meter field attracted the attention of Rockwell Manufacturing Co., and he was associated with Rockwell from 1936 until he joined Lancaster Meter in 1951. Mr. Gilmore has taught classes at the gas measurement short courses.



"Milk runs" save lives in So Cal Gas division



Key player on the emergency equipment team is this converted "milk wagon," into which are loaded all the items of equipment shown on this page.

A "MILK WAGON," once retired from service as a district regulator truck, is now off the surplus list and playing an important role in emergency operations at Southern California Gas Co.'s southern division at Compton.

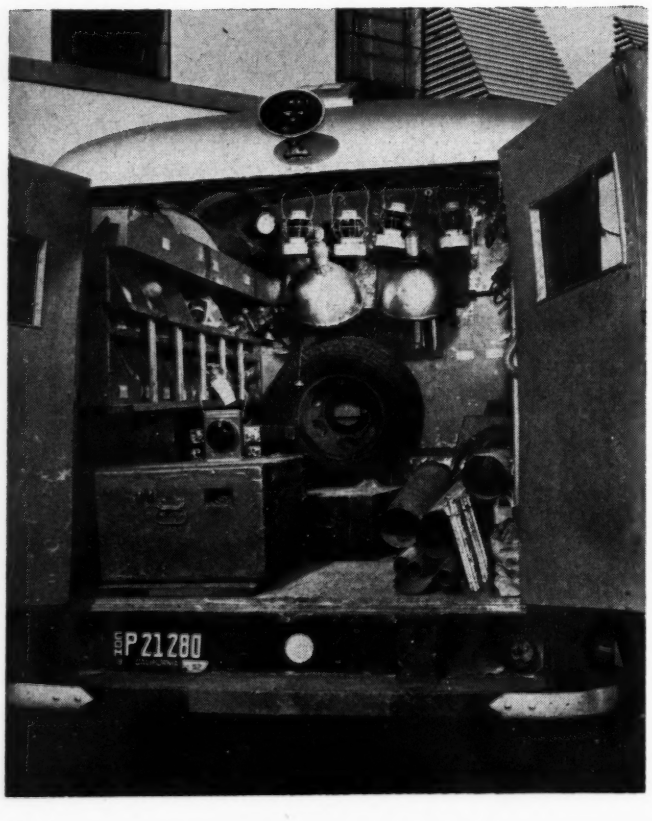
Equipped with many types of safety and lifesaving equipment that might be needed on any type of emergency job, the truck may be speedily dispatched to the scene of a main break, broken service, report of blowing gas leak, and planned shutdown—in fact, to every location where "live" gas must be controlled. Teaming up with two mobile telephone-equipped trucks, one a regular street department repair truck and the other a serviceman's pickup, the emergency truck holds the equipment needed to give complete protection to workmen and the public.

Carried in orderly array are 119 fittings and 121 tools (including duplications), ranging from pressure control tools and fittings to rain pants, and from split repair sleeves to emergency blankets.

Only one man is needed to run the safety wagon, a storekeeper on duty. Thoroughly briefed on the job, he is sent to the scene of an emergency by the dispatcher as soon as a trouble report is received. Altogether, the three units contain all equipment that might be needed to handle any situation.

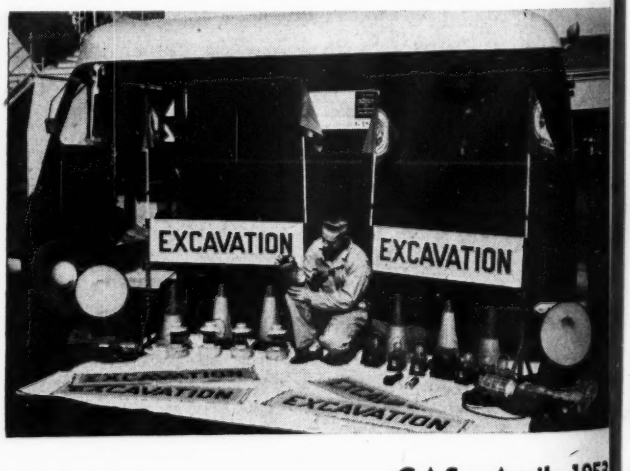
On-the-job procedure is to attack the problem deliberately and calmly. Division Superintendent Ralph Haun has instructed his men to first make the area as safe as possible to prevent possible injury or further damage before repairs are started. Accordingly, equipment is arranged in the truck for use in three steps. For the first phase, that of "making the job safe" for the public, the layout includes signs and flags, flashlights and lanterns, barriers and flashers. The second group prepares for the final step of actually carrying out the repair work, and includes fresh air masks, blankets, fire extinguishers, ladder, vent stacks and tripod, safety belts, etc.

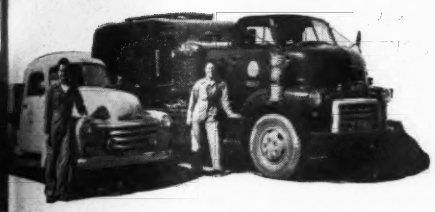
For controlling the gas, making bypasses, and repairing leaks, the truck



Into this compartment at left are loaded 119 fittings and 121 tools not carried in the street or service trucks, that can do any of the tasks required on emergency or planned shutdown jobs. Typical of the care with which the equipment is arranged are the harness snaps from which the lanterns hang, preventing their bouncing off on to the floor during rough rides.

First things first: below, equipment needed to isolate the job and make the area safe is first off the truck. Flashlights, flags, barriers, street markers, lanterns and floodlights are included in the "package."





Service and street department trucks, both radiotelephone equipped, team up with the safety wagon to handle emergency jobs.

holds numerous items in a variety of sizes such as pressure control fittings, leak clamps, bull plugs, wooden plugs, couplings, sleeves, canopies, dead end plates, copper and plastic tubing, etc.

The two fire extinguishers are stored in the cab of the truck, together with the lighting unit including generator, cord, and reel.

Mobility and fast dependable communications (plus excellent working relations with police and fire departments) are what make the jobs go with a minimum of hazard. Trouble calls are routed to the street crew dispatcher from any of a number of sources. Police or firemen may turn in the alarm, a serviceman or a district foreman may spot a blowing leak, or the call may come from the public. The dispatcher immediately notifies the storekeeper on duty to proceed in the safety wagon to the trouble spot. The serviceman and street crew leadman are called on the mobile radiotelephone, with which their vehicles are equipped, and dispatched to the job using coded message for brevity and to eliminate public alarm. Police and/or fire departments are called out as needed. If the report is merely of a gas odor, they are seldom required, but if the pipe has been cut by trenchers, polediggers, road graders or other heavy equipment, or if a gas leak is blowing, they are immediately summoned.

Each district foreman has a vehicle equipped with a mobile radiotelephone, as does the district superintendent, and they are advised of all emergencies. All units are equipped with a horn, and when the driver steps out of his car he flips a switch which permits the horn to give a signal sound if he should receive a call.

The superintendent, foreman, and assistant district foreman are also provided with "emergency manuals," in effect comprehensive bibles of operation for guidance in case of trouble. Information includes public emergency services (fire and police departments, ambulance services, hospitals, resuscitator service, and others); company emergency directory, including a complete telephone directory of key company personnel; and a miscellaneous listing of public utilities services and contractors.

They also carry a "Major Disaster Area Control Book," complete with "intersection" drawings; and even emergency cards permitting them to pass fire lines and a supply of small change for making telephone calls are provided.

At the scene of the trouble, emergency crews go about their task of making the area as safe as possible. Barriers are set in place, lighting is set up as needed. Meters and pilots are shut off as necessary, and sources of ignition in the vicinity such as rubbish fires are snuffed out. Firemen and policemen help "set the stage" for the repair job; their close working cooperation has been helpful in limiting damage and preventing losses. Hose is strung out and firemen stand by with fog nozzles ready while police assist with traffic control during emergency.

Before excavations are started, vent stacks are set up to clear low levels.

Every possible precaution is taken to keep the safety wagon ready for call at an instant's notice. Two independent ignition circuits are built into it, each operating off a separate battery. The batteries are kept constantly charged with trickle chargers. The lighting machine is started up every week to make certain it is functioning. After every use, fresh air masks are disinfected and date-tagged.

The safety wagon has proved its worth on 15 emergencies during the past nine-month period. The jobs ranged from broken services to a blowing leak on a 16-in. main. It is used more frequently on planned shutdowns however and has become a familiar sight in the southern division where rapid growth of the system has required frequent area pressure reinforcements and facilities expansion.

Mounted in the truck cab are the lighting unit, including generator, 250 ft of electric cord (in three sections) and reel, and two fire extinguishers.

This equipment is used primarily to make the job safe for the workmen themselves. The metal container holds an antiseptic blanket for use with burn victims. In the cardboard carton is a shock blanket, used in cases of chill or asphyxiation. Vent stacks clear low levels of gas.

For leak repair, gas control, and pressure control, the truck's stock holds a variety of equipment in a number of sizes. From left to right, principal items are half soles and Henderson clamps, large fittings, split couplings, pressure control fittings, bull plugs and wooden plugs, roll-a-grips, leak repair fittings.

Basic machine for the leak repair package is this 3-ton clam-hoe mounted on an International 10-wheel, tandem axle truck.

Wisconsin Gas develops "ideal" leak repair package

EXPEDIENT handling of gas leak repairs requires a highly mobile unit capable of digging and backfilling in addition to transporting such necessary tools and equipment as hand shovels, pick axes, bars, odd lengths of pipe, heavy air tools, sump pump, compressor, air mover, and earth auger.

Having experimented with just such a unit for the past seven years, engineers of the Wisconsin Natural Gas Co., Racine, have developed what they consider an ideal leak repair "package." Small and fast enough to get about easily and quickly yet capable of performing all the functions necessary for efficient leak repair, the unit saves time and money and the tempers of employees and customers alike.

The development of this fast, compact unit began in 1946 when officials of the company purchased their first two Bucyrus-Erie Hydrocranes. Since then, company engineers have designed a special housing for compressor, tools, and materials. Five of these package units are now owned by the company. They are used mostly on leak repair work but the machines are very seldom idle because they are also used for trenching, handling pipe in the yards, handling heavy assemblies, digging valve pits, and other spot jobs.

No two of these units are exactly alike since improvements and refinements have been made as field experience indicated the need for them until the latest machine, described below, was developed. This is the ideal unit in this company's judgment.

On leak repairs, the first two Hydrocranes had to pull trailers on which were mounted air compressors and compartments containing the needed tools—or they had to be accompanied by a truck similarly equipped.

In 1948, R. L. Goodland, one of the company's engineers, conceived the idea of mounting the Hydrocrane, compressor and tool compartments on a single chassis. He and Paul Bardeen, transportation engineer, went to work on the idea and came up with the first leak repair package.

After considerable field experience with this first package unit, engineers decided a larger truck was desirable because the International KB-7 on which this unit was mounted was being loaded to near capacity. So in 1950, three more of the units were ordered, to be mounted on International L-190 trucks.

In the summer of 1951, Bucyrus-Erie Co. introduced the Hydrohoe, an all-hydraulic dragshovel front-end for its ⅜ yd Hydrocrane. Because of the obvious advantages of a combination clamshell and dragshovel unit for gas company work, the company decided to use the 3-ton, H-3 Hydrocrane with its dragshovel attachment as part of the unit described in this article.

An H-3 Hydrocrane, readily convertible

Ready to go to work. This package is capable of digging, backfilling, and transporting all the tools and equipment necessary for efficient leak repairing.

With the clamshell attachment, the machine is ideal for spot repairs.

Removable compartment, bolted to the crane base, is used for miscellaneous equipment, such as foul weather gear.

to the dragshovel front-end (Hydrohoe), was mounted on an International LF-192 10-wheel, tandem axle chassis with a 193-in. wheel-base and an L-200 front-end. Tires used were 9.00x20, 12 ply. Two sets of hydraulic outriggers, mounted in tandem, extend and retract horizontally and vertically in seconds, taking excess weight and strain off truck and tires and thereby increase the Hydrocrane's capacity.

A specially designed body to house a 160-cu ft Worthington air compressor and all other tools and equipment is mounted between the truck cab and the Hydrocrane. This housing is 63½ in. above the top line of the frame and extends 18 in. below the same line on both sides. The height is necessary to clear the compressor when it is raised to the maximum height of the belt tightening screws (61¾ in.). Both the crane and the compressor are powered by the truck engine, the crane from an SAE power take-off and the compressor through a Hercules D775 split power take-off, eliminating the inconvenience and expense of providing a separate power unit.

A removable metal plate designed to leave a clear space of 50 x 36 in. in the roof of the body, permits removal of the air compressor. This plate has a 24 x 24-in. sliding cover attached to provide ventilation for the compressor. The front bumper boom support was adjusted to establish a clearance of boom over housing of 1½ in. The body is 94 in. wide.

The special enclosure is divided into two main sections. The forward section with two vertical doors equipped so they can be hooked open for ventilation on either side houses the compressor. Installed in the compressor compartment in such a way as not to interfere with the compressor dip stick or access for maintenance is a sump pump holder—a cup about 6 in. high with an inside diameter of 9 in.

A bin is provided on each side of the compressor compartment for tools and materials. The bin on the right side is removable to provide access to the compressor. Also located on the right side of the forward section are two Wirt-Knox hose reels—one above the removable bin and one below. The upper reel holds 100 ft of compressor hose, the lower 50 ft.

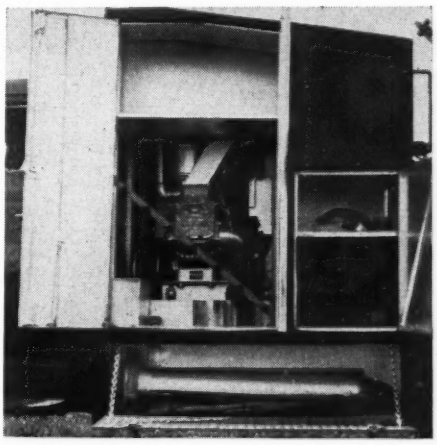
The rear section of the special housing contains one through-box at the bottom for long tools and pipes, accessible from either side. The rear right side contains eight small bins. Sliding doors on the rear of the special compartment conceal two more sections of small bins.

Side boxes constructed on each side of the body below the level of the top of the chassis frame have extra strong horizontal doors, hinged at the bottom and equipped with chains to hold them in a horizontal position when open because these doors are often used as steps to gain access to the compressor or one of the other compartments. The bottoms of these side boxes are reinforced to carry heavy air tools.

An additional removable compartment is mounted on the left side of the crane base when in travel position. It is bolted to the platform by four bolts inside the bottom of the compartment.

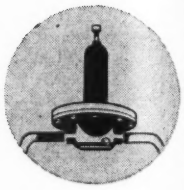
This unit and its predecessor are paying off for their owners. They repair an average of six leaks per day and can be on the job in a matter of minutes with all the equipment and tools necessary to do a fast, efficient job of leak repair.

Right side of housing contains two hose reels. The bin between the reels is removable to provide access to the compressor. The lower portion is a through-box for long tools and pipes. Note the side box for heavy tools.



The special housing on the left side contains the compressor, tool compartments, and side box.

Making high pressure service installations



By **KENNETH W. PERSON** • Minneapolis (Minn.) Gas Co.

LIKE nearly every gas utility, Minneapolis Gas Co. has encountered a number of new problems in attempting to expand its distribution system to meet the ever-increasing demand for gas from the suburbs, brought about by the general population trend away from the cities.

The typical mushroom pattern of this suburban expansion frequently requires gas companies to extend service out along highways to small communities or developments, which widen out like the head of a mushroom along the main stem of travel. Usually, the most desirable and economical method of doing this is to run a high-pressure line to these communities and then reduce the pressure through a district regulator to serve customers at distribution pressures. But the route along these relatively high pressure lines normally is banked with potential customers. Serving them presents a problem.

Depth of growth

Since the depth of growth along these lines is not normally deep enough to warrant installation of a parallel distribution system, Minneapolis Gas has found it feasible to serve these customers directly from the high pressure mains.

As we continued our expansion in suburban areas, requests began to come in for individual service from people along the lines. Since some of the high pressure lines carry pressure up to 75 psi, the company decided that services could be tapped onto these lines but that, on any service coming from a main carrying pressure higher than 25 psi, two regulators would have to be installed.

Our normal practice on a pounds pressure service has been to install the service regulator inside the customer's basement as near to the service entrance as possible but, with the use of the additional first-stage regulator, we decided that its safe location would be outside the building, near the customer's property line. This would provide a gas service carrying line pressure of 75 psi from the gas line in the street or highway into the customer's property line; at the property line the pressure would be reduced to approximately 3 psi, a satisfactory intermediate distribution pressure. The reduced pressure would then be carried into the building where it would be further reduced to the proper utilization pressure.

Our next step was to decide whether to install the first cut regulator above or below ground and how to protect it. In our part of the country, where it is extremely cold in the winter, outside regulators are usually installed below ground, so naturally this location was considered first since it appeared to be the normal one.

We felt that installation of an underground vault to house the first cut regulator was not only a costly installation but a cumbersome one that really afforded little advantage in the successful operation of the meter. A vault would have to have an access cover installed flush with the surrounding lawn surface so that it could be easily located and permit access to the regulator. This would be a source of annoyance to the customer in the upkeep of his property. Also, unless the vault were proportionally oversized, it would be difficult to work on the regulator. The vault also would serve as a collection point for water that might, if it were to collect high enough over the regulator, cause the regulator to operate poorly. On the other hand, the vault definitely would keep the regulator out of sight.

Burying the regulator

In an effort to save the cost of the installation of the vault, we next considered merely burying the regulator without the benefits of the vault, and backfilling the normal soil over the regulator. We found that flooding of the vent line or the top of the regulator with ground water could be prevented by extending the vent line up to just below the surface of the ground and then placing a bell-type piece of pipe over the extended vent line and the spring housing the regulator. Here, in the inverted bell-type piece of pipe, the compression of the air by the rising water would prevent the water from coming up very high in the pipe and prevent the flooding out of either the vent line or the top of the regulator. This installation would place the regulator out of sight and would further remove the objection and the cost of the underground vault. But in a country where the ground in the winter becomes frozen from 2 to 4 below the surface of the ground, it would

be difficult to gain quick access to the buried regulator in the event of trouble.

So we discarded these two possibilities and decided on an aboveground installation. Since the gas to be served to these customers would come directly from the servicing pipeline, we knew that it would be in a very dry condition. The normal danger of exposed outside piping, freezing of the accumulation of condensation that is present in a manufactured or a conditioned natural gas, would not be experienced on these installations, and the ease of access to an aboveground installation is evident. We felt that, if the installation were not unsightly and were kept to minimum dimensions, it would not be objectionable to customers, even though they were not accustomed to seeing regulators installed aboveground as they commonly are in warmer parts of the country. The possibility of tampering with this type of installation is quite remote and, since it was a dual regulator installation, we felt that no damage could be caused to either the customer or the public. The advantages of easy access in all types of weather and in all types of soil conditions thus appeared to outweigh the disadvantages and, consequently, the final decision was made to install the first cut regulator aboveground, in or as near to the property line as possible.

In the past, we have used restricted main taps on intermediate pressure service installations. This practice was continued for services coming from the higher pressure mains. For a single domestic dwelling, the main is tapped with a No. 7 drill with a 0.2-in. diameter.

Shutoff installed

We thought it advisable to install a shutoff at the gas line as close to the tap as possible. The valve service tee was chosen as the fitting to install at the main in order that the main could be tapped without permitting gas to escape and also providing the service shutoff at the main. On cast iron mains, the valve service tee is inserted into a saddle that is clamped around the main. On steel mains the steel valve service tee is welded directly to the main.

A tamper-proof lubricated cock was also chosen for installation aboveground and ahead of the first-stage regulator. The first-stage regulator is equipped with a ⅛-in. orifice. The restricted tap at the main, in addition to the restricted orifice in the regulator, serves to reduce the possible free flow of gas in the service in the event of a rupture of the line beyond the first-stage regulator or when the first-stage regulator becomes inoperative. The capacity of the service is sufficient to handle the load of any single domestic customer under ordinary pressure circumstances and, if main pressures were greatly reduced, the service would still be adequate to handle the minimum domestic load.

At the customer's end of the service, inside the basement wall, another lubricated tamper-proof cock was installed on the service ahead of the second-stage regulator. The second-stage regulator is our normal house regulator installation with a relief valve vented to the outside and is of adequate capacity to relieve the pressure of the service to a safe pressure in the event of a failure of the second-stage regulator. The general construction methods and the material used on this higher pressure service were not greatly changed from the ordinary procedure used on other services. Standard-weight pipe is used throughout and all joints wherever possible are of the compression coupling type.

Threaded joints

It has always been company policy to keep the number of threaded joints to a minimum on any outside installation. Consequently, the bends for the vertical offset where the service comes up out of the ground and goes to the regulator and out of the regulator and back down underground are all made by bending the pipe rather than by using threaded fittings (see *Figs. 1, 2,* and *3*). The only threaded joints used were at the gas cocks and regulators. In order to remove the first cut regulator, a joint was placed aboveground in the outlet leg of the vertical offset. This joint is of the compression lock coupling type. Since our normal service installation requires only bare steel pipe, this higher pressure service is installed in the same way except that on the vertical legs of the regulator offset where the pipe comes out of the ground a plastic tape is used as coating for the bare steel pipe. We believe that this tape will protect the surface of this area against possible rapid corrosion.

The first-stage regulator offset is fabricated and assembled in the shop and the entire assembly is delivered to the crew on the job. In the normal process of the service installation, the crew inserts the first-stage regulator assembly at or near the property line. In the event that at a later date it appears economical to install

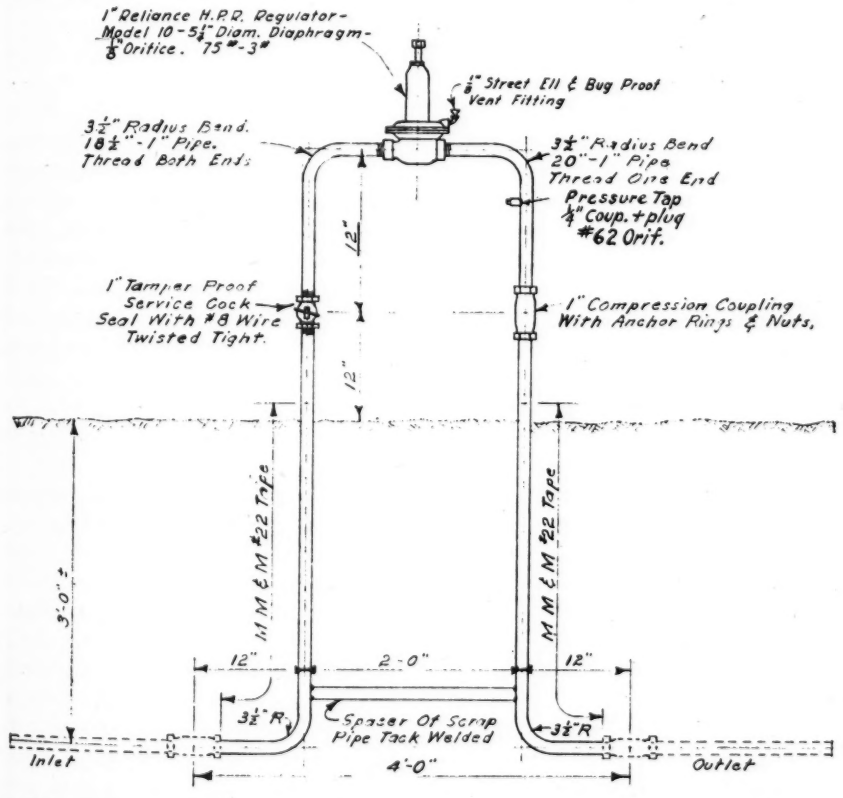

1" Reliance H.P.R. Regulator - Model 10 - 5½" Diam. Diaphragm - ⅛" Orifice. 75 #-3#
1" Street Ell & Bug Proof Vent Fitting
3½" Radius Bend. 18±"-1" Pipe. Thread Both Ends
3½" Radius Bend 20"-1" Pipe Thread One End
Pressure Tap ¼" Coup. + plug #62 Orif.
12"
1" Tamper Proof Service Cock Seal With #8 Wire Twisted Tight.
1" Compression Coupling With Anchor Rings & Nuts.
12"
3'-0"±
M M & M #22 Tape
M M & M #22 Tape
12"
2'-0"
12"
3½" R.
Spacer Of Scrap Pipe Tack Welded
3½" R.
Inlet
4'-0"
Outlet

Fig. 1. Diagram of the first-stage regulator used by Minneapolis Gas for making high pressure service connections.

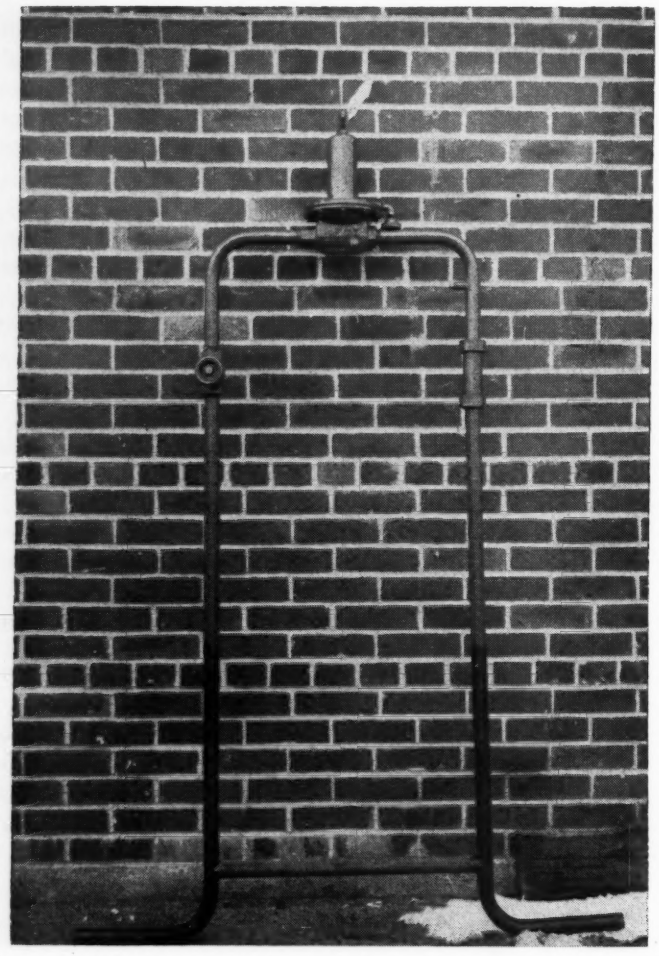


Fig. 2. First-stage regulator assembly as fabricated in the shop.

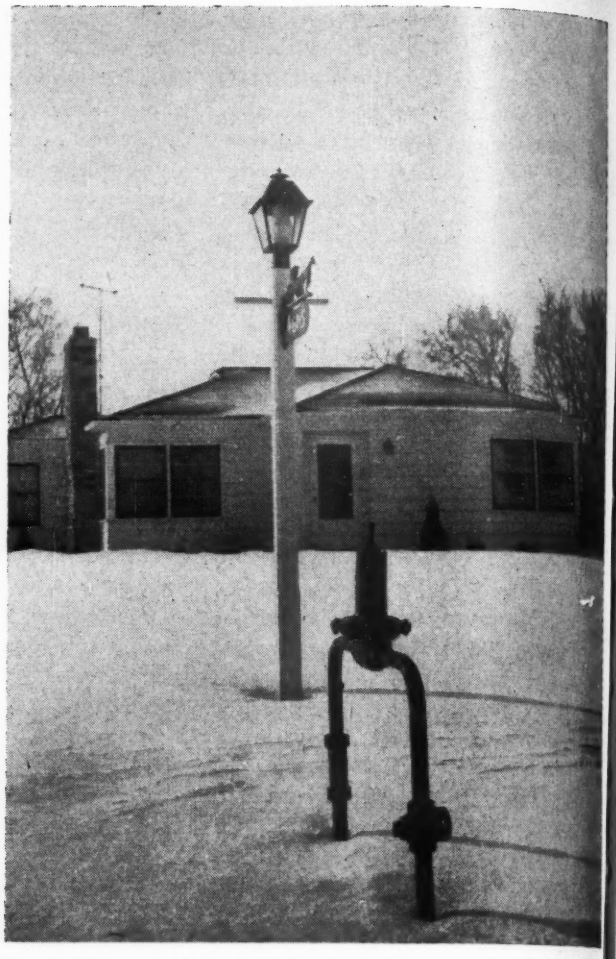


Fig. 3. The regulator after installation at a customer's home.

a separate lower pressure distribution system paralleling the higher pressure line, then the service could be reconnected to the new lower pressure main and the first-stage regulator assembly could be removed from the service and replaced with a straight piece of pipe.

Green paint

The first-stage regulator assembly that projects aboveground is painted green to blend in with the customer's lawn during the summer season. Every effort has been made to prevent the installation from becoming unsightly or objectionable to the customer. A ¼-in. coupling is welded to the outlet leg of the first-stage regulator assembly to provide a pressure tap to test the setting of the first-stage regulator. The leg is drilled through the coupling with a No. 62 drill and the coupling is plugged with a regular pipe plug. A scrap piece of pipe is welded between the legs of the regulator assembly to serve as a brace and also as a means of removing any strain that would be transmitted to the threaded joints at the shutoff cock or the regulator in the event an unusual pull was introduced to any other part of the service. Minneapolis Gas now has over 100 of these high pressure service installations in action and, at the end of several months of operation, our experience with them has been quite satisfactory.

One bit of difficulty was encountered on the first below-freezing night that some of these installations were in service. On the following morning most of the installations were frozen up in the first-stage regulator and the flow of gas through the service was cut off. A crew had to go along the 30-some installations that were then in service, remove all the first-stage regulators, and replace them with fresh new regulators. The original regulators had to be thawed out and dried before they could be used again.

Prior to increasing the pressure on these lines, they had been served with gas coming from the regular city distribution system. This gas is normally conditioned with steam rehumidification and fogging oil. Moisture had evidently accumulated in the line during the time that it had operated with the gas that had been humidified and, since being converted to a higher pressure, the dry gas had not yet absorbed the moisture. Consequently, in below freezing temperatures, the moisture was collecting in the first-stage regulators and freezing. Immediate steps were taken to remove the moisture from these lines and with the use of the dry gas, direct from the servicing pipelines, there has been no reoccurrence of this experience.

Occasional comment

There have been occasional comments about the strange appearance of a gas pipe sitting in a customer's front yard but there have been no complaints from the individual customers. In conclusion we can say that the installation of high pressure services with two stages of regulation is an economical and satisfactory method of serving an increasing number of customers over an expanded area. A safe design with a minimum of operational difficulties will give the benefits of gas to many, many more customers.

Cities are taking steps to force better soil compaction methods

By C. C. WESTMORELAND • Southern California Gas Co., Los Angeles

The three-part series beginning on this page forms three more chapters in the developing story on street work, which has received close editorial attention during the past 12 months because it is such a new story, with so much still to be written.

These three articles—the first reporting the thinking of city officials, the second detailing soil tests, and the third describing modern techniques and equipment—were adapted especially for GAS from a panel discussion presented at the Pacific Coast Gas Assn.'s technical services conferences Feb. 18-19 in Hollywood, Calif.

THE serious congestion of our streets and highways is causing a great deal of comment from the motoring public. Public officials concerned with street and highway construction and maintenance are under pressure to obtain maximum improvement of the problem for the monies expended. Their growing interest in backfill and compaction is readily understandable.

A representative of the Institute of Transportation and Traffic Engineering recently pointed out that the percentage of total monies appropriated for highway construction being used for maintenance work only has shown a constant increase during the past several years—despite the expanded freeway construction program. Officials can foresee the time when maintenance work on this extensive freeway system will be of such magnitude that much of the appropriations for street and highway purposes will be used solely for maintenance. Anything promising reductions in traffic interference and maintenance costs is receiving serious consideration.

Cities are taking steps, but their solutions vary to a considerable extent. A model ordinance developed by the East Bay (Northern California) chapter of the American Public Works Assn. requires that all soils be compacted to a density of 90%. If such a density cannot be obtained, imported materials are required.

The Los Angeles city council passed, in May 1950, a resolution which has since been filed so has no force at present. The resolution pointed to the difficulties of traffic congestion resulting from the lag in time between backfill and resurfacing, and recommended that a "more efficient method be used so that resurfacing can be accomplished immediately after the excavation work is completed." It cited the unsatisfactory conditions resulting from flooding, and recommended that the board of public works require "public utilities to mechanically compact all heavy soils and permit water flooding only of lighter type soils such as sand . . ."

The resolution went to the board of public works and was then referred to the substructure committee of Los Angeles for study and a recommendation; but as a result of that committee report and questions raised by the city engineering department, action has been deferred.

City engineers are generally approaching the subject cautiously. They are reluctant to make expensive requirements that would be applicable to public works projects and result in increasing prices of bids. Writing and enforcing of such ordinances also entail some complications.

It is generally recognized that flooding or jetting is a satisfactory means of consolidating trench backfills in some types of soils, and any ordinance should take this into consideration. Few city departments are sufficiently familiar with the soil areas in their jurisdictions to specify where mechanical means must be used.

Granting that this point is settled, the next question raised is, "Can the permanent resurfacing be applied immediately following mechanical compaction of the backfill?" Since the only real justification for temporary resurfacing is to allow consolidation of the backfill by traffic, the need for temporary surfacing can not be substantiated, and is an expense that excavators cannot reasonably be expected to bear. This puts the city in the position of either requiring the resurfacing crews to meet the schedule of the excavator or allowing the excavator to contract the permanent resurfacing to a paving company. In some cases, the street repair crews' schedule is not sufficiently flexible to cope with such an arrangement, and in at least some cities there is a reluctance to allow street repair work to be done by other than city crews.

This immediate resurfacing proposition also raises a question of how city inspectors are to determine that the required degree of compaction has been achieved so that the permanent resurfacing can be applied without fear of failure. The test methods commonly used have proved to be a problem in that they are too lengthy to be used for job control. Experience has shown that it is not unusual for 24 hours or more to elapse between the time the test sample is taken and the results are available to the construction superintendent in charge of the job. This means that long sections of compacted trench must be left barricaded, awaiting the outcome of a given test. This results in poor public relations for the excavator and defeats one of the principal advantages of mechanical compaction—the prompt reopening of the street to the motoring public.

Despite the rather confusing status of this subject at the present time, I believe that advances are being made that will ultimately lead to a reasonable solution. The current interest and discussion of the subject, and its related problems, is accomplishing two things: First, it is causing ethical excavators to question whether or not they have really done everything that could reasonably be expected of them to reduce to a minimum the nuisance to the motoring public; and second, a review of the problems involved reveals the need for more basic information on the subject of soil mechanics that can be applied to trench backfill and compaction. This awareness is prompting the accumulation of data that can eventually be used to establish reasonable regulations which can be effectively applied and enforced.

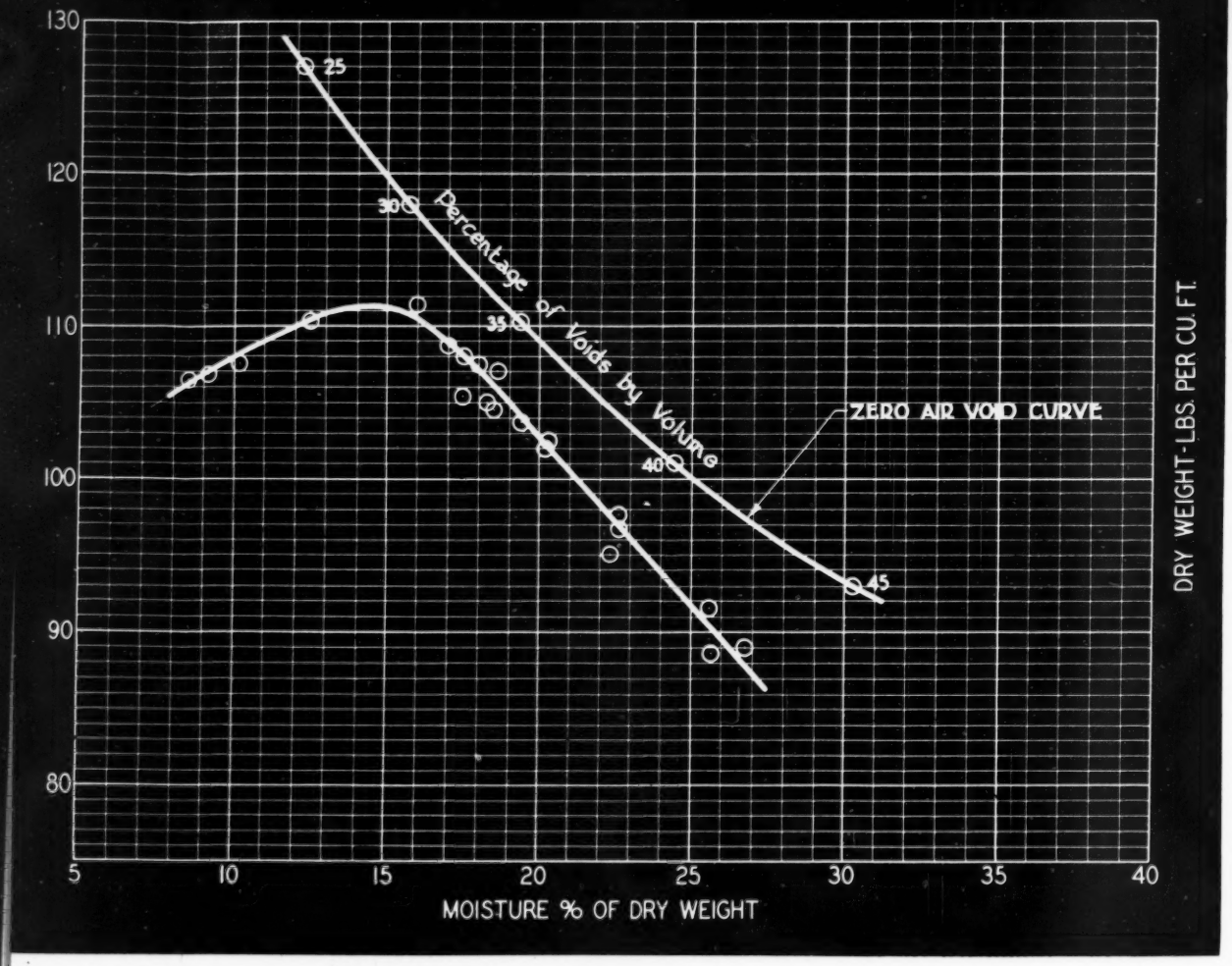


Fig. 1. Plot of dry weight or density of soil in pounds per cubic foot vs. moisture content.

Needed: Quick, accurate soil density test methods

By **SIDNEY GALLY** • Southern California Gas Co., Los Angeles

WHEN soils are mechanically compacted, the soil particles are forced closer together, increasing the soil density. This makes the soil more stable and better able to support a load. There is a need for quick and accurate soil density test methods to enable utilities to comply with city, county, or state specifications.

The moisture content of soil as it is being compacted has a marked effect on the density, as is illustrated in *Fig. 1*. This is a plot of the dry weight or density of soil in pounds per cubic foot versus the moisture content at the time the soil is compacted for a given compactive effect. The density reaches its maximum at about 15% moisture in this example. The per cent moisture at which the curve reaches its peak is termed the optimum moisture content; the peak itself is spoken of as the maximum density.

Compacting the soil harder or in thinner layers will change the position of the curve, although the general shape will remain the same. The peak will move up and to the left. The greater the compactive effort, the higher will be the maximum density, and the less will be the optimum moisture content.

Tests available

Several standard tests are available for determining the moisture-density curve. The American Society for Testing Materials and the American Assn. of State Highway Officials have similar tests, of which there are several variations. Th state and the city of Los Angeles ea has one, and each gives a different cur and maximum density.

If it is required by the specificatio that 90% relative compaction achieved in the backfill, it is necessa to reach a dry density of 90% of ma mum density using whatever compacti test the specifying agency designates. is necessary to know what "90% co paction" means in pounds per cubic fo In this case the maximum is about 1 so the "90%" would be about 100 per cu ft.

The apparatus that is used to obta the curve consists of a cylinder into whi a weight is dropped to compact the so This is done in a certain number of la

ers at so many blows per layer. When the cylinder is filled, the soil must be weighed to determine the density. A sample of the soil is weighed and dried to determine the moisture content.

This process, which must be repeated for several different moisture percentages, is slow and hardly applicable to field use.

The soil types containing clay, which are the poorest supports for paving, are also the hardest ones to compact; conversely, the best subgrade soils are the easiest to put back in the trench.

There is a classification system, which rates soils according to their performance as highway subgrades which might be of some use in trench backfilling, but in urban areas where soils vary frequently, it would be a formidable job to classify and map them all.

Suppose a utility has the problem of complying with the 90% compaction requirement. First, it must determine the maximum density from the curve for the particular soil being compacted. If previously collected data aren't available, the test must be run. The type of compaction equipment and layer thickness must be considered. The moisture content of the spoil bank must be known to determine if moisture is to be added. Finally, the density of the compacted soil must be measured.

Test methods

There are a number of test methods for measuring density. There's the coring device that is shoved down into the soil bringing back with it a sample that can be weighed and its wet density computed. Then the moisture content can be determined by drying the sample in order that the dry density may be found. This method would be rapid if it were not for the time required to obtain the moisture content. Because the sample is small, the accuracy is only fair.

Another more accurate method has been used but it is slow and applicable only on large jobs. The soil is excavated down to the desired level (see *Figs. 2* and *3*). A sample of soil is dug out and weighed; then, the volume of the hole from which the soil was taken is measured with dry sand of known density. But the moisture content must be determined in the laboratory by the usual methods.

Work is being done on devising rapid tests. Cornell University, working with and for the Civil Aeronautics Authority, has developed some rapid tests for measuring moisture and density using neutrons and gamma rays. It is still in the development stage, but results to date show promise.

Fig 2. The field displacement test method illustrated here has proved to be quite accurate, but is slow and applicable only on large jobs.

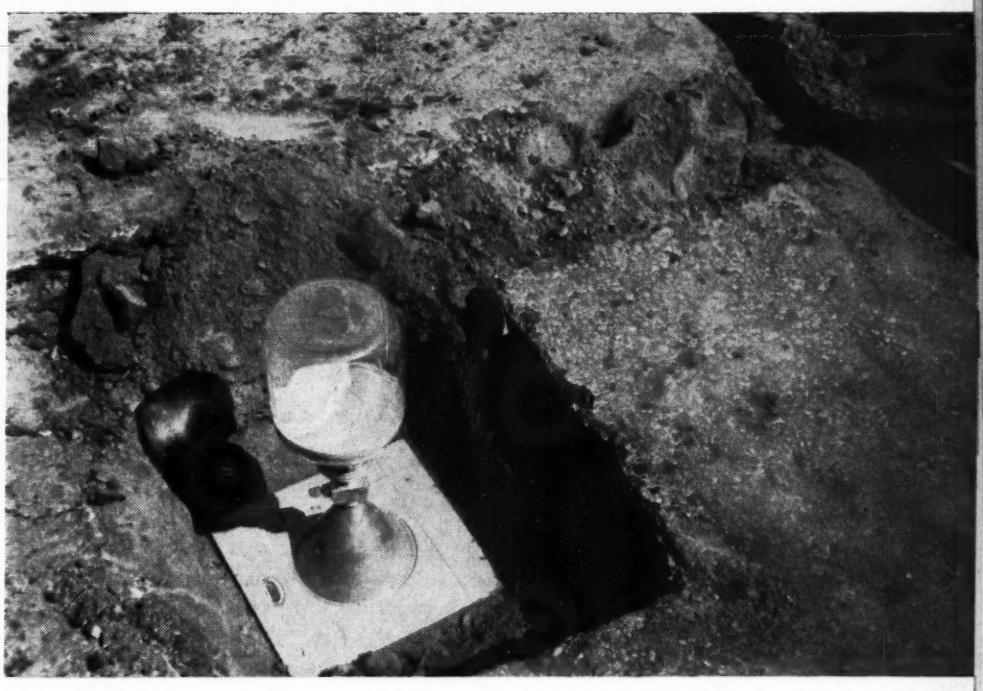


Fig. 3. In this test, a sample of soil is dug out and weighed and the volume of the hole is measured with dry sand of known density.

But the field man is still without a practical working test. There must be some other solution to the problem. Soil classification and mapping is useful, but in a city frequent soil changes would render it useless in many instances.

Another suggestion

Here is another suggestion: Instead of a density standard, require only that all the soil removed from a trench be replaced in the trench, compacted uniformly. The soil would occupy the same volume as it did prior to excavation, giving the same average density as before. No field tests on the job would be made. A "rule of thumb" would have to be established so that the soil could be handled and inspected and its characteristics determined roughly. From this determination, a decision could be reached on the job as to the best compaction method to use to return all the soil to the trench properly.

The only actual test work then would be what was needed for a sampling and quality control program.

Techniques and equipment for soil compaction

By **GEORGE M. BABBE** • Southern California Gas Co., Los Angeles

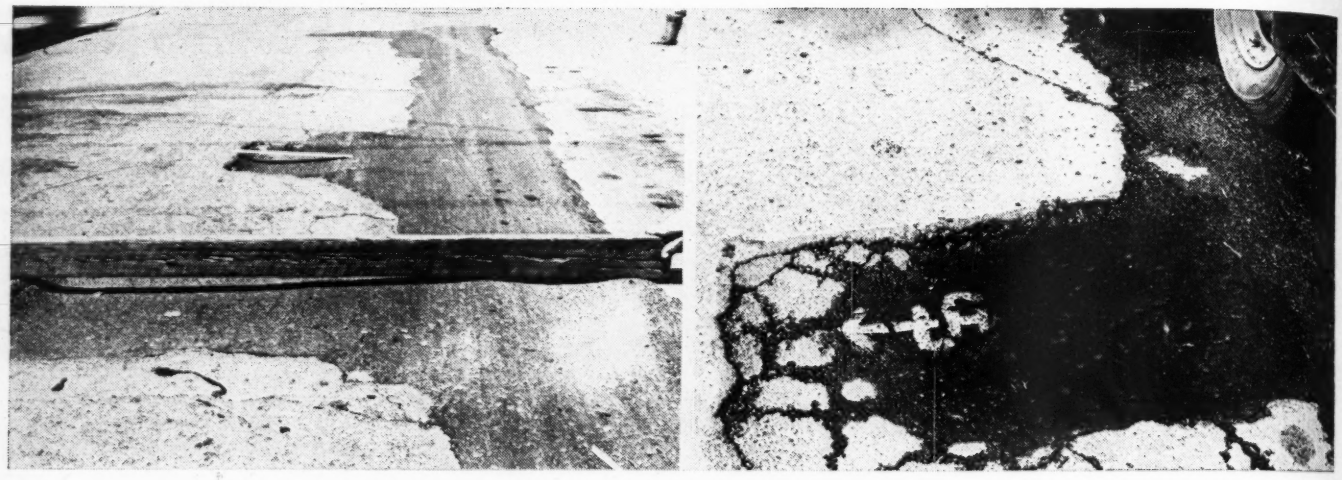


Fig. 1. Critical attention of the motoring public is being attracted increasingly toward such trench failures as these, making it necessary for utilities to pay closer heed to the problems of breakout, paving replacement, and compaction.

MORE people today are driving more miles in heavier, faster cars than ever before. This fact poses a definite problem for trench excavators throughout the country, and particularly in the Pacific Coast region where increases in population and automobile registration far exceed national averages. With heavier and faster traffic, utility trenches in streets and highways must withstand ever-increasing loads. And because more people are using the streets, any trench failures (such as pictured in *Fig. 1*) which result in traffic hazards receive more critical attention from the motoring public, and through them, of the state and municipal officials responsible for street condition.

Trench excavators are aware of their responsibility in this regard. For example, in several cities, San Diego and Los Angeles to name but two, excavators and municipal officials have formed substructure committees which are developing standards for soil placement, trench barricades, traffic control procedures, etc., aimed at minimizing traffic interference resulting from excavation work in busy streets. And to assure that backfilled trenches resulting from such work will stand up under today's heavier traffic loads, excavators are working with manufacturers to develop and refine backfilling equipment and techniques.

Techniques and equipment

Some of these techniques and equipment are discussed here. This is by no means a complete summary of all the types and styles available—it is simply an indication of some of the typical units which are being used presently for soil compaction. Since the field of trench backfill and compaction is relatively new, further developments in equipment design and construction can be expected.

None of the types discussed here is presented as a cure-all for all trench compaction problems. Soil characteristics vary widely as do the economic considerations for specific jobs. A particular compaction method may be excellent for one type of soil and not suited at all for another; likewise, one piece of equipment may be particularly suited for use on a long, deep trench, but its use on a shorter job may result in unjustifiably high compaction costs.

There are a few other basic considerations which are related to this matter of field equipment and procedures. It might be well to review these briefly before discussing specific techniques and equipment.

1. The importance of trained and interested operators cannot be overemphasized. Soils constitute a very complex construction material, probably the most complex the excavator encounters. Proper handling of soils requires a knowledge of their characteristics and behavior and an appreciation of the importance of the work to be done. In the past, I'm afraid that too many of us considered a pipeline job completed when

Fig. 2. Water consolidation has advantages of low equipment and operating costs, but its use should be limited primarily to sandy soil. It increases the ultimate dry weight.

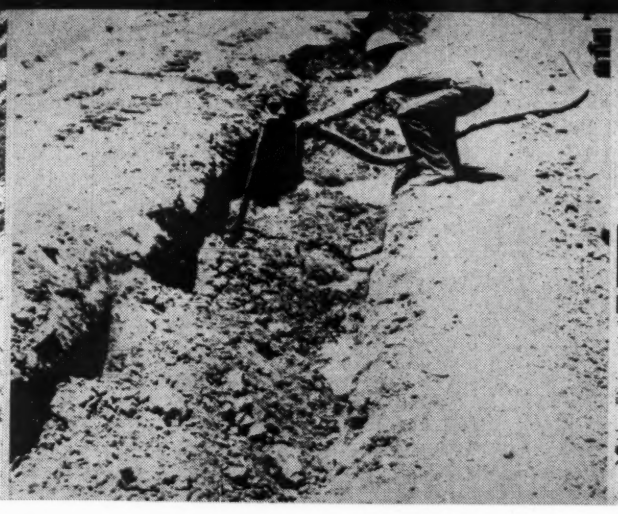


Fig. 3. This is a jetting operation, flooding from the bottom up. In finer grained soils, water consolidation is not a recommended method of soil compaction.

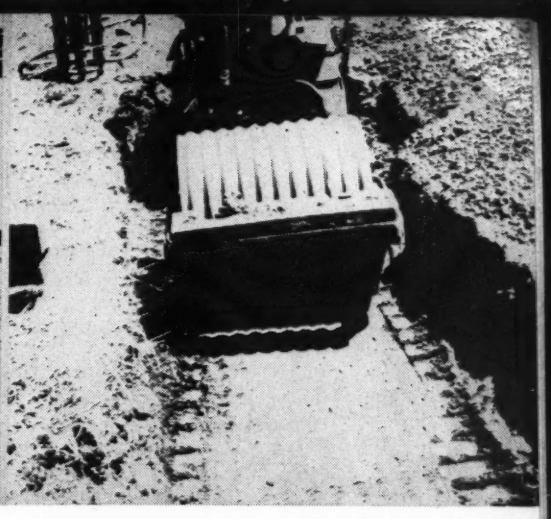


Fig. 4. Rolling is an old technique, used frequently with flooding or jetting. One problem is to obtain equipment of the proper size and shape for the job. This equipment uses a cylinder weighted with a concrete fill.

the line was gassed and felt that backfill and compaction was an incidental operation that could be done by the lowest-paid help on the crew. To avoid sunken trenches and attendant poor public relations and unnecessary maintenance costs, however, it is essential that qualified and interested men be assigned this work.

I suspect that we have placed the blame for trench failures on certain jobs on the particular technique that was used, when in fact the failure was due to poor workmanship or to the misapplication of the technique to soils for which it was not suited. When a weld fails in service, we don't criticize welding in general—we check the compatability of the weld rod and parent metal and we review the welder's ability. The same approach should be followed in evaluating trench performance in relation to compaction procedures.

2. Unfortunately, in too many municipalities the excavator does not have enough latitude in selection of equipment or compaction techniques. Ordinance requirements, in many cases decades old, restrict him to a particular procedure whether or not it is appropriate for the soil type encountered, the size of the job, or for the traffic conditions to which the trench will be subjected. Excavators should work with municipal officials to develop standards and specifications for trench compaction which will assure satisfactory trench performance, but which at the same time are flexible enough to recognize variations in soil types, loading conditions, and economic considerations. Particularly at this stage, there is a real danger in establishing restrictive requirements which would prevent taking advantage of further advances in our knowledge of soil behavior and compaction techniques.

The utility excavator has a definite responsibility to the motoring public for the satisfactory performance of trench backfill. He has an equally important responsibility, however, to his organization's owners and rate payers to assure that all work is done at the lowest possible cost. No one in the community benefits when trench compaction requirements are unreasonably stringent or when they necessitate the use of particular equipment when other types will do an equally satisfactory job at a lower net cost.

3. As a related point, municipal officials should recognize that with higher standards of trench compaction, the economies of immediate permanent resurfacing should be taken advantage of whenever job size and other conditions make it practical to do so. This avoids the extra costs involved in installing and maintaining temporary resurfacing materials while street traffic compacts the soil; also the extra costs of removing this temporary material when permanent repairs are made and in some cases the added costs resulting from breaking back from the original trench edge which some municipalities feel is necessary to assure proper bond between the parent street surface and the repair material.

Traffic performance

With these thoughts in mind, here is a brief description of some of the techniques and equipment available for the trench exacavator's use. These are all intended to improve traffic bearing performance through compaction or consolidation of the soil in the backfill. In general, the denser the soil can be made (i.e., the greater its dry weight per unit of volume), the greater its load supporting characteristics will be. Consequently, compaction techniques are aimed at increasing the number of soil particles in a unit volume, by washing them together, squeezing them together, pounding them together, or shaking them together. Each of these four general techniques is discussed below.

Water Consolidation. One of the oldest compaction procedures is flooding or jetting, washing soil particles together

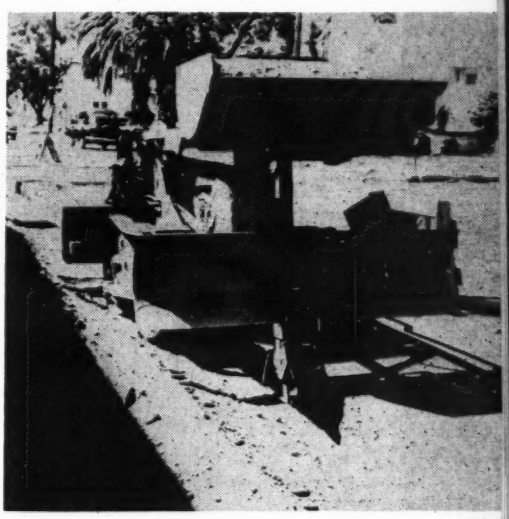


Fig. 5. Considerable elaborate equipment has been developed to speed the rolling operation and bring improved results. The skip loader shown, which holds rock and gravel as a weighting element, was fabricated for connection to an Oliver Cletrac.

Fig. 6. The Triplex tamper is a gang-mounted, synchonized set of three tampers, hand-operated.

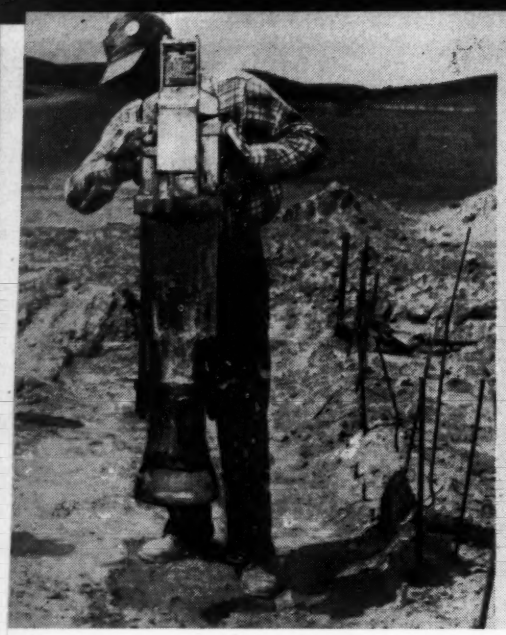


Fig. 7. Heavy weight of this Barco gasoline powered hand-operated tamper gives high degree of compaction.

Fig. 8. Self-propelled Emsco tamper offers economies on larger jobs, particularly along parkways.

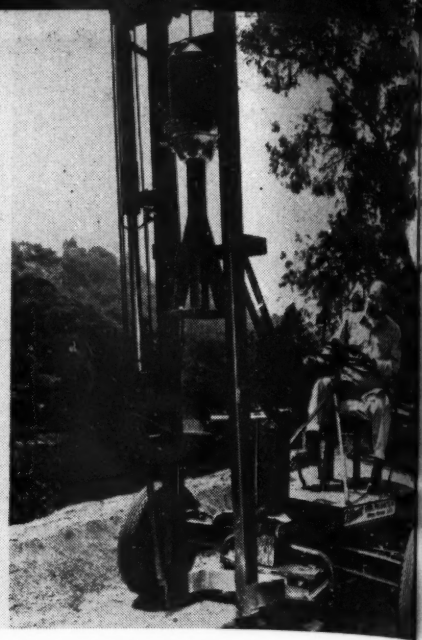


Fig. 9. Ottawa unit uses pile-driving action for high degree of compaction where mechanization is economical.

through the flow of water which also acts as a lubricant. Equipment costs for these procedures are low, simply the cost of hose, valves and nozzles; since water is relatively inexpensive in most areas, operating costs are also low.

Although these advantages of water consolidation (such as pictured in *Figs. 2* and *3*) have led to widespread use of this technique, it does offer some definite operating problems under particular conditions. For one thing, it is difficult to distribute the water evenly throughout the backfill material; certain sections become saturated and erode away, while others receive less water than desired. In those sections where moisture content is far in excess of optimum, any other subsequent compaction effort such as rolling will be far less effective than if the moisture content is near the optimum point. Such conditions are complicated by the use of a temporary resurfacing material which acts as a sealer and prevents evaporation of water from the saturated soil. This is particularly troublesome if sub-surface drainage is poor.

Water consolidation

Consequently, water consolidation techniques are best used with sands or predominantly sandy soils, those relatively large particle soils which drain well. They cannot be used so satisfactorily with the finer grained soils, particularly the cohesive soils such as clay or abode which expand and contract to a marked extent with increases and decreases in moisture content.

Rolling. Rolling is another of the older compaction techniques, used frequently in conjunction with flooding or jetting. It is used quite extensively for compacting large earth structures such as earth-fill dams and for street and highway compaction. Quite elaborate equipment has been developed for these uses. In addition to the truck rolling procedure frequently used for trench compaction, other special units, such as those shown in *Figs. 4* and *5*, have been used for this operation.

Factors affect compaction

Three factors affect the compaction obtained with rolling equipment: the area of the rolling surface, the total weight applied, and the design or shape of the rolling surface itself. One problem facing the trench excavator in this respect is the selection of a rolling device which will fit into the trench to compact the lower courses of backfill material and which can be operated close to the edge of the trench.

Impact Compaction. The use of equipment which delivers a sharp blow to a relatively small area of the backfill material is receiving increasing attention for trench compaction applications. Such equipment is now available in a wide range of sizes and powers, from the familiar hand-held pneumatic tamper to large self-propelled units suitable for wide, deep trenches.

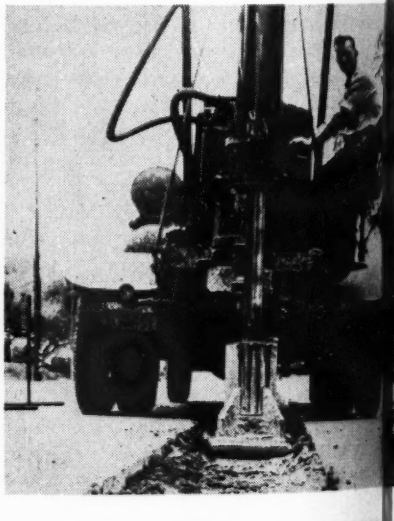
Fig. 6 shows a special version of the hand-operated pneumatic tamper. This unit consists of three separate tampers, gang mounted and synchronized to facilitate control. Another variation is the gasoline powered tamper pictured in *Fig. 7*. Because of its heavy weight, this unit permits high degrees of compaction to be obtained.

Larger jobs

For larger jobs where mechanization offers economies, several self-propelled or truck-mounted units can be used. Some examples of these are shown in *Figs. 8, 9, 10,* and *11*. *Fig. 12* pictures a general purpose unit, designed not only for soil compaction but for backfilling and pipe handling as well. (Most of these larger units, incidentally, can be used for pavement breaking in addition to compaction.)

Selection of such equipment for a par-

Fig. 10. Truck-mounted version of the Emsco tamper. This powerful unit has a flexible range of sizes.



ticular job is largely a matter of economics. The smaller, lower powered units may require more time to achieve a desired degree of compaction in a given volume of soil, but this is offset by their lower capital and operating costs. The net cost per cubic foot of compacted soil should be the governing factor, and this will vary with job size, etc.

Vibratory Consolidation. A good deal of work has been done recently in the development of equipment designed to consolidate soils by literally shaking the soil particles together. As yet, such equipment is not particularly suited for trench compaction applications, being intended primarily for footings for large buildings and for airplane landing strips along beachfronts. A major limitation is the fact that this technique, at its present stage of development, works only with sands or predominantly sandy soils. It is not suitable for the finer particle, cohesive soils. Further developments may increase the range of its application.

One of three procedures

Although it is the most widely used technique, soil compaction is actually only one of three procedures which might help improve trench performance. It must be remembered that soil compaction is only a means to an end. The basic objective is not to increase soil density per se, but to improve the soil's weight bearing characteristics.

Two other procedures may be used to accomplish this same objective. One is in the field of design of backfill and paving materials. Stress analyses indicate that traffic weights are dispersed and distributed rather rapidly below the surface of the street. In general, full load stress is imposed upon the soil only to a depth of about three times the diameter of the load surface.

For example, the per square inch weight of an automobile carried on each of its wheels must be supported by the soil only to a depth of about three times the diameter of the contact area between the tire and street surface. At any point below this three-load diameter level, the only bearing strength required of the soil is that needed to support the weight of the soil above it. Consequently, the selection or placement of materials which would withstand surface loads in this critical zone and which would permit full lateral transfer of such loads might obviate the necessity for expensive compaction procedures.

Waterproofing soil

The second possibility is that of chemically or mechanically waterproofing the soil in the trench, by some means preventing the entry of water into the trench backfill material. The weight-bearing characteristics of soil vary markedly with moisture content. When dry, soils present excellent characteristics, as witness the ease of driving a car along a sun-baked country dirt road. Too much moisture significantly reduces the load bearing ability of soil, as witness the hub-cap deep mire of the same dirt road following a rain storm. Some work has been done in this field, again not specifically for trench applications, however. Although currently the cost of such chemical waterproofing is too high to warrant its general use, further developments along this or similar lines may make such a technique very practical and economical.

Further developments

Within the field of compaction itself, the trench excavator would benefit by further developments, particularly with regard to control procedures and tests. Soil compaction at the present time is more of an out than a science. Operating control and inspection are consequently quite subjective for the most part, depending upon the skill and judgment of the men involved. The objective tests which can be used now are unfortunately involved and time consuming and not particularly suited for operating control. Development of fast field-testing procedures to determine density and moisture content in particular would be very advantageous. If nothing else, such tests assure consistent and objective inspection, which would do much to reduce the uncertainty now facing the excavator in this regard. They would also facilitate the development of uniform and realistic specifications for trench backfill and compaction.

It is very encouraging to note the progress that has been made in this field during the past several years. Interested municipal officials and excavators have been working together more and more through such agencies as local substructure committees and the American Public Works Assn. Such cooperative effort aimed at the obtainment of completely satisfactory trench performance at reasonable cost is bound to be fruitful.

Fig. 11. This Emsco tamper, mounted on an I-beam, moves laterally and is particularly suited for trenches of greater widths.

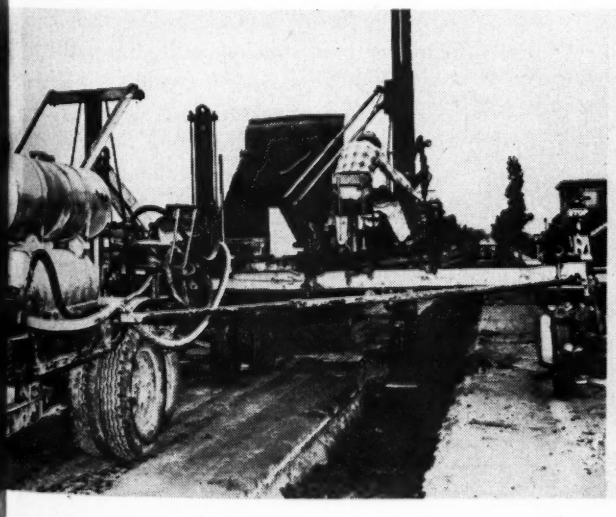
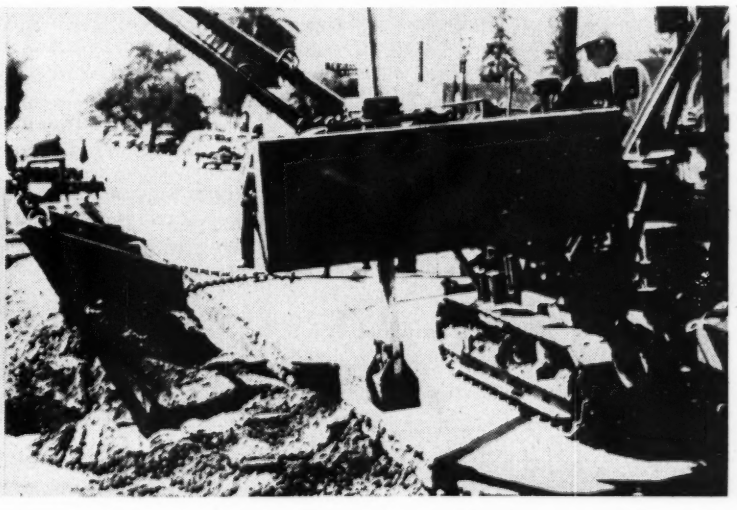
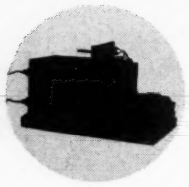


Fig. 12. This Cleveland model is a general purpose unit, laying pipe and backfilling as well as compacting and cleaning up after the street work has been completed.



Bureau of Standards designs new electronic flowmeter



A NEW type of electronic flowmeter, capable of measuring the air currents in a still room or the rapid flow of fluids in pipes, has recently been developed at the National Bureau of Standards. This device, designed by Henry P. Kalmus of the NBS staff, utilizes the change in velocity of sound waves to measure fluid flow. It has a very fast response and does not obstruct the fluid currents to make the measurement. In addition, the signal-to-noise ratio is sufficiently high to permit the measurement of extremely small velocities.

Mechanical devices

Most of the present methods for measuring the velocity of flowing liquids depend on mechanical devices that usually introduce discontinuities in the fluid and have inherent inertia that prevents faithful reproduction of fast velocity changes. One type of flowmeter utilizes the principle of the homopolar machine but this method cannot be used for gases and the instrument is, at present, restricted to the measurement of conductive fluids. Another method makes use of the resistance change in hot wires placed in the path of fluid flow but, besides presenting an obstruction to the flow, the hot wire is not generally applicable to fluids that would change chemically or physically as a result of the heat from the wires.

In the newly developed flowmeter, a sound wave is transmitted over a fixed distance through the flowing fluid and the phase of the received wave is compared with that of the transmitted wave. The sound energy is imparted to and taken from the fluid through the walls of the containing vessel. No part of the measuring system need come in direct contact with the medium under study. This characteristic of the system makes the unit applicable for the measurement of blood flow in the aorta or for the detection of the flow of chemicals in a closed system, for example, the coolant in a chain reactor. Minor modifications will permit the measurement of the flow of such fluids as gas or oil in a metal pipe, or a determination of the relative velocity of a ship to that of the water through which it is moving.

Simple system

In instances other than those involving extremely high velocities, i.e., in wind tunnels, a simple system utilizing merely a stationary device to transmit energy into the medium and another stationary unit to receive it would be impractical because changes in distance or propagation velocity would produce errors far greater than the variations due to flow. For this reason, the transmitter and receiver of the new flowmeter are exchanged periodically without varying their locations. This is accomplished by using identical magnetostrictive or piezoelectric exciters, such as barium titanate crystals, as transmitter and receiver and by switching their connections alternately to the receiving and transmitting channel.

Thus, the phasemeter displays two phase shifts alternately, one a function of the sound velocity plus the fluid flow and the other a function of the sound velocity minus the fluid flow. The difference between the two phase shifts is a measure of the velocity of the fluid. The switching can be made to operate faster than the inherent variations occurring in either the transmitter, receiver, or even the medium. Hence, the variations will occur at a minimum of one complete transmitter-receiver switching cycle and the phase difference will remain unaffected.

In the first experimental model of the NBS flowmeter, a mechanical switching system operating at a 10-cycle-per-second rate is employed. The switching is achieved by a commutator that is inserted between the crystals on one side and a 100-kc oscillator and receiver on the other. The oscillator is connected to an amplifier containing carefully designed limiters that produce a square wave voltage to be injected on one grid of a multigrid phasemeter tube. The receiver amplifier also furnishes a limited signal to the other grid of the phasemeter tube.

The phasemeter tube is bypassed by a capacitor so that fluctuations at the sound wave frequency are removed and the fluctuations at the switching rate may be applied to a synchronized rectifier. The rectifier is actuated in synchronism with the commutator, but its active period is shorter so that harmful transients occurring during the crystal transition are suppressed.

A simple commutator, one that would merely switch the crystals alternately to the receiving and transmitting channels, is unsuitable because of the capacitive cross-coupling between the two channels. In order for the transmitted and received pulses to be absolutely representative of the separation between the crystals and the velocity of the fluid, there must be a minimum of coupling between the two channels. By very careful design of the commutator, the leakage capacitance can be reduced to about 5×10^{-5} $\mu\mu$f, and many of the fringe effects and ground currents can be eliminated.

Commutator rotor

The rotor of the commutator is made in the form of a sandwich, consisting of two pieces of insulating material fastened to a grounded conductive shield. Two conductive segments or sectors are mounted to the insulating material but with no connection to the shield. The shield is brought out to the maximum diameter of the rotor, thereby reducing the fringe effects between the sectors. Four rows of carbon brushes are arranged so that the crystals are connected to either the receiver or oscillator for all positions of the rotor. Capacitive coupling between the sectors is reduced by maintaining a clearance of less than 0.015 in. between the sector shield and the rotor.

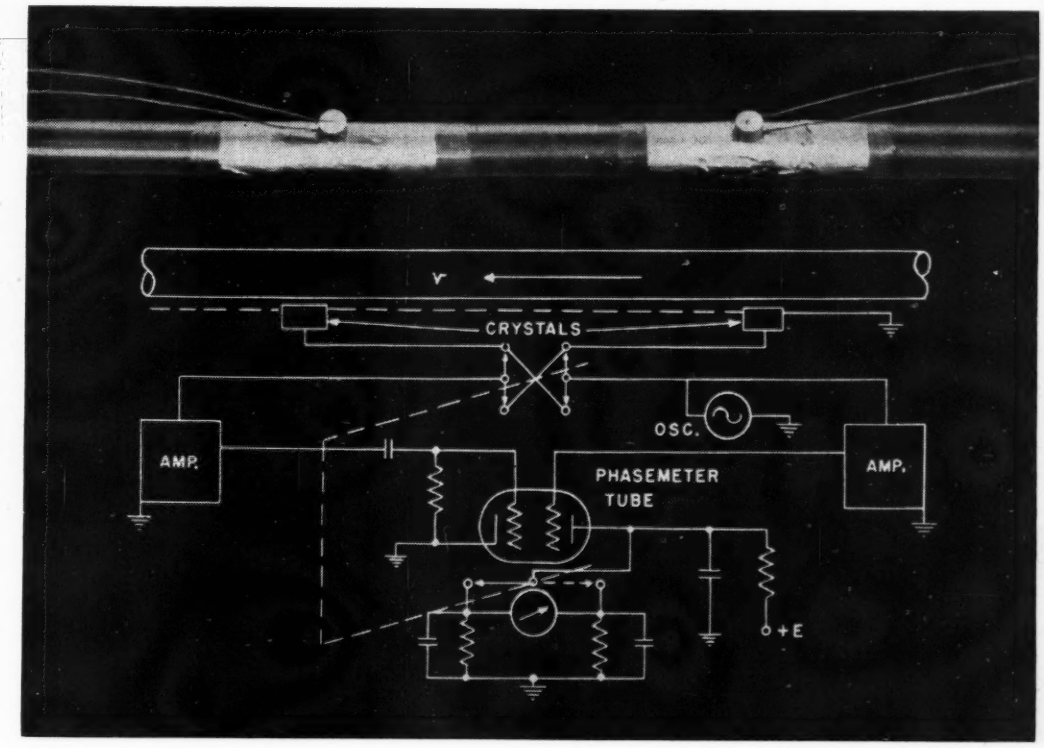


Fig. 1. The crystal arrangement (above) and the circuit diagram (below) of the recently developed electronic flowmeter, capable of measuring the air currents in a still room or the slow or rapid flow of fluids in pipes.

Similarly, close-fitting shields are provided at the ends of the rotor to assist in reducing fringe effects.

The output of the phasemeter is applied to an electronic high-impedance voltmeter (which can be calibrated directly in terms of velocity) through the rectifier-switch geared to the commutator drive. Fast velocity changes can be observed on the screen of a cathode-ray oscilloscope connected to the plate of the phasemeter tube. Thus, if the plate voltage is made visible, the difference between the voltages developed "upstream" and "downstream" can be used directly to estimate the flow-velocity instantaneously.

A modification of the commutation operation is the use of an electronic switch. By using vacuum tubes for example, the switching frequency can be increased to 1000 cycles and the time of response can be correspondingly shortened. Four pentode amplifiers are placed between the crystals on one side and the oscillator and receiver on the other. The screen-grid supply is derived from a square-wave generator with a frequency equal to the switching rate (1000 cps). When the screen voltage is positive, the pentode acts as a normal amplifier; when the potential becomes negative, the electron stream in the tube is blocked and good shielding is provided. The amplifiers are so arranged that one pair operates at a time during each half of the switching cycle.

Further modifications in the flowmeter are being considered; one in particular is concerned with flow in metal pipes. A pulsed and gated phase comparison system will be used for this purpose to eliminate the effects of the direct transmission of the sound through the wall of the pipe.

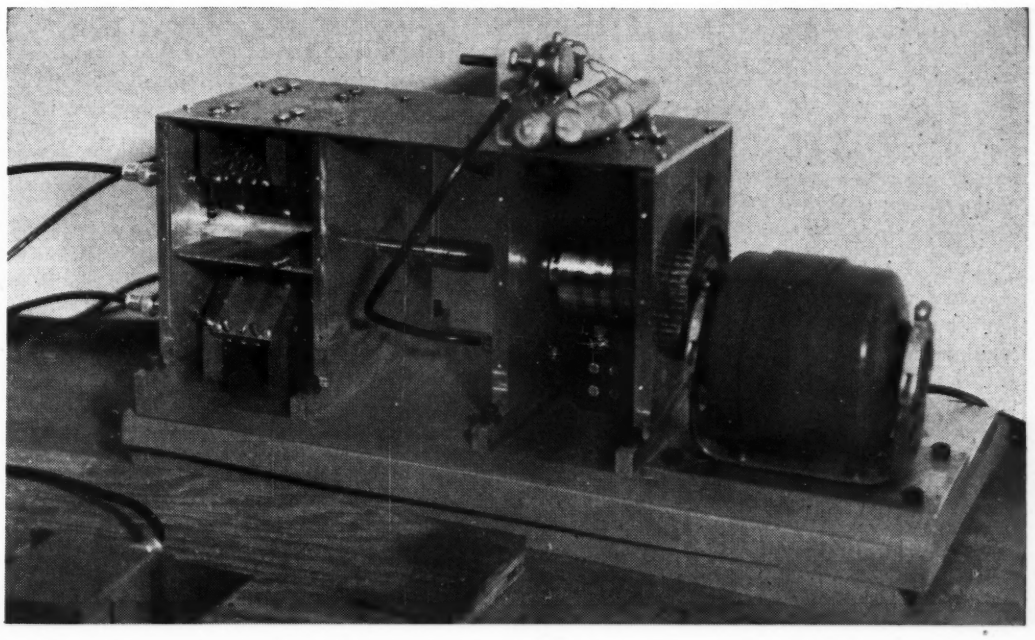
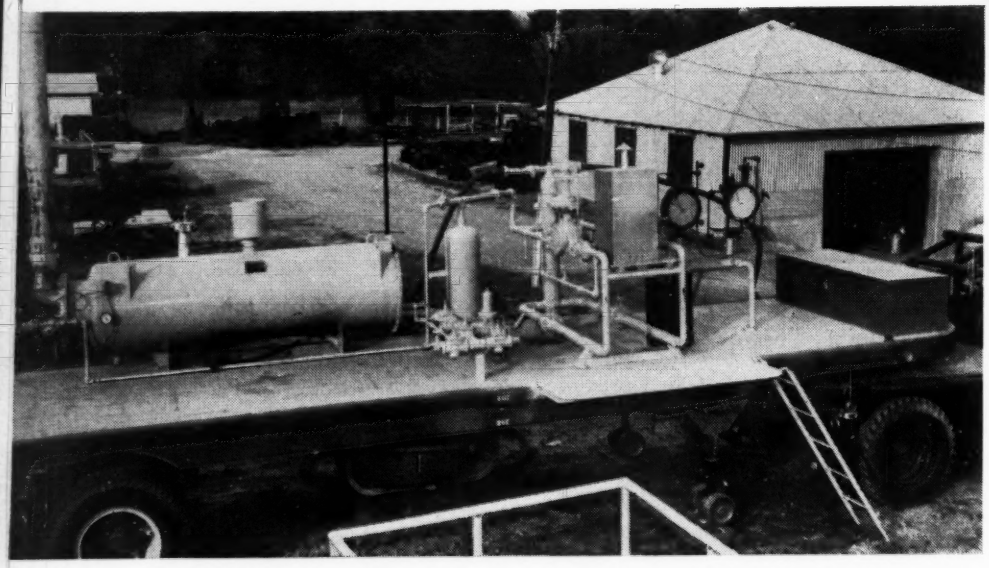


Fig. 2. The mechanical switching system used in the NBS flowmeter. The commutator is at the left and the compartment on the right contains the switching unit for the synchronous rectifier.

Truck-based unit feeds propane-air for shutdowns

Operator can control flow of both air and propane and, without moving, have before him three visual checks on unit's efficiency. Burner box is to the operator's left; his hand is on hand control of air flow. City station is in background.



The 28-ft float contains the compact unit, water bath heater, and tool chest plus storage space for hoses. The orifice meter at right measures difference in pressure of downstream flow side of air and propane. Slightest deviation in proper pressure balance is reflected immediately on chart and may be corrected by hand valve on the air flow.

By HARVIE CHAPMAN

LONE Star Gas Co.'s portable propane-air unit, developed by company engineers in 1951* for use in providing substitute gas during shutdowns, has now been designed into a permanent rig bolted to a 28-ft trailer float. Improvements in layout and equipment built into the apparatus now enable operators to set it up and begin the job of feeding substitute fuel into a city's system in less than an hour from the time of arrival.

So flexible is the unit that it has been utilized by Lone Star on 20 occasions during the temporary suspension of natural gas service for repair or relocation of lines. It has been used in jobs ranging from supplying a small community of 100 meters for five hours at a flow of 2 Mcf per hour to providing industrial customers in another city with fuel for 7½ hours at a flow of 37 Mcf per hour.

Perhaps the greatest improvement has been in making the unit more compact. This is reflected in the ability of one man to stand in one position to control the air and propane flow and have before him simultaneously three visual checks on the operating efficiency of the unit.

These three checks are a Ranarex gravity indicator, an orifice meter to measure the difference in pressures on the downstream flow side of the air and propane, and pilot burners.

The Ranarex will give a continuously responsive reading within a few seconds after a propane-air ratio adjustment is made.

The three burners, contained in a protective shield with glass window, are adjusted with natural gas before the propane flow is started. One burner is set for best flame characteristics (proper mixture), one is set with excess air, and the third is set with a slight yellow tip or too little air. After first adjustments, the operator maintains the same characteristics by controlling the flow of propane and air.

The chart on the orifice meter, an 8-hr chart, is sensitive to the slightest deviation from the proper pressures.

Experience has simplified the procedure to the point that pipeline utilitymen are efficiently carrying out the entire operation without needing an engineer.

Contained on the float are the unit with meter runs, two orifice meters, regulators, a water bath heater for vaporizing the propane, the Ranarex gravity indicator, the burner box, and a tool chest to carry the meters and other equipment during transit. Supplements to the float are the propane tank truck and air compressor.

Based at one of the company's pipeline headquarters just outside of Dallas, the float can be hooked to truck and on its way to any part of the Lone Star system, covering 388 towns in Texas and Oklahoma, in a matter of minutes.

*The first units were described in an article, "Propane Air Fills in for Gas, Forestalls Line Repair Outage," which appeared in *GAS*, February 1952, pp. 54-5. Additional operating data and specifications were tabulated in that story.

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ESTIMATED PROVED RECOVERABLE RESERVES OF NATURAL GAS IN THE UNITED STATES

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	Changes in Reserves During 1952					Reserves as of Dec. 31, 1952[2]				
	Reserves as of Dec. 31, 1951 (1)	Extensions and Revisions[2] (2)	Discoveries: New Fields, Pools in Old Fields[2] (3)	Net Change, Underground Storage[3] (4)	Net Production[4] (5)	Total (All Columns Less "Net Production") (6)	Non-Associated[5] (7)	Associated[6] (8)	Dissolved[7] (9)	Storage[8] Underground (10)
Arkansas	931,314	91,070	3,020	630	41,452	984,582	528,029	138,462	315,465	2,626
California[9]	9,482,445	269,427	65,938	(—)1,925	475,863	9,340,022	2,516,241	2,156,918	4,653,946	12,917
Colorado	1,138,451	31,851	42,181	0	48,234	1,164,249	524,113	39,286	600,850	0
Illinois	227,133	14,750	1,768	0	32,000	211,651	4,251	5,000	202,400	0
Indiana	30,807	9,990	1,472	1,790	7,345	36,714	3,552	3,100	27,225	2,837
Kansas	13,457,498	1,167,567	21,912	1,110	454,522	14,193,565	13,707,255	132,627	320,946	32,737
Kentucky	1,325,588	46,696	11,360	2,379	72,500	1,313,523	1,240,879	0	59,080	13,564
Louisiana[9]	29,005,031	2,176,296	1,540,159	0	1,269,872	31,451,614	25,000,197	4,185,548	2,265,869	0
Michigan	203,025	3,296	18,612	40,498	10,888	254,543	132,752	0	38,645	83,146
Mississippi	2,439,969	21,771	118,224	417	216,321	2,364,060	1,700,671	401,453	261,479	457
Montana	828,107	12,885	17,236	2,051	32,676	827,603	697,705	36,593	83,691	9,614
Nebraska	95,810	1,264	3,964	0	7,080	93,958	64,895	7,701	21,362	0
New Mexico	11,589,979	2,669,335	217,160	4,458	442,043	14,038,889	10,653,682	2,155,593	1,209,904	19,710
New York	66,793	200	0	5,047	3,400	68,640	47,502	0	468	20,670
Ohio	689,135	32,607	8,275	33,966	32,500	731,483	561,537	0	31,470	138,476
Oklahoma	11,804,337	547,606	199,997	13,781	800,892	11,764,829	7,273,114	951,250	3,491,935	48,530
Pennsylvania	619,455	36,595	91,950	56,385	94,800	709,585	515,866	0	36,470	157,249
Texas[9]	105,653,229	1,459,565	2,950,264	13	4,330,308	105,732,763	69,209,845	20,462,637	16,058,448	1,833
Utah	95,845	188,045	2,802	0	3,280	283,412	265,105	0	18,307	0
West Virginia	1,671,499	108,315	23,400	26,256	169,400	1,660,070	1,470,546	0	73,285	116,239
Wyoming	2,340,298	35,660	21,379	11,994	88,207	2,321,124	1,455,746	350,249	502,443	12,686
Miscellaneous[1]	115,752	9,679	49,970	0	6,055	169,346	66,682	0	102,664	0
Total	193,811,500	8,934,470	5,411,043	198,850	8,639,638	199,716,225	137,640,165	31,026,417	30,376,352	673,291

[1] Includes Alabama, Florida, Maryland, Missouri, North Dakota, and Virginia.
[2] Excludes gas loss due to natural gas liquids recovery.
[3] The net difference between gas stored in and gas withdrawn from underground storage reservoirs, inclusive of adjustments.
[4] Net production equals gross withdrawals less gas injected into underground reservoirs. Changes in underground storage and gas loss due to natural gas liquids recovery are excluded. December production estimated occasionally.
[5] Non-associated gas is free gas not in contact with crude oil in the reservoirs.
[6] Associated gas is free gas in contact with crude oil in reservoirs.
[7] Dissolved gas is gas in solution with crude oil in the reservoirs.
[8] Net gas placed in underground reservoirs for storage purposes only.
[9] Includes off-shore reserves.

14.5—8.6=5.9 trillion increase

GAS RESERVES REACH 199 TRILLION

As of Dec. 31, 1952, proved recoverable reserves of natural gas in the United States totaled 199.7 trillion cu ft, up 5.9 trillion over reserves a year earlier in spite of the year's all-time high production of 8.6 trillion cu ft.

Facts and figures were announced last month in the annual joint report of the Committee on Reserves of AGA and API.

The discovery of 5.4 trillion cu ft of reserves in new fields in '52, compared with 3.0 trillion in '51, reflects the increase in exploration activities that has resulted from the still-increasing demand for natural gas. Nearly 199 billion cu ft were added to estimated reserves in underground storage. However, further exploration and drilling in existing fields added only another 8.9 trillion cu ft during the year, considerably less than the record 13.0 added in '51. Consequently, the total net increase for 1952 was off 2.3 trillion from the 8.2 net increase in 1951.

Reserves of natural gas liquids also rose to a record level of nearly 5 billion bbl at the end of 1952 in spite of a record production of 285 million bbl. Crude oil reserves totaled approximately 28 billion bbl and total liquid hydrocarbon reserves were 32.96 billion bbl compared with 32.19 a year earlier.

Nine states, California, Illinois, Kentucky, Mississippi, Montana, Nebraska, Oklahoma, West Virginia, and Wyoming, registered decreases in total remaining gas reserves during the year; seven had decreases in '51. Largest gain was scored by Utah, which nearly tripled its reserves, but most of the other states showed only small percentage gains.

SUMMARY OF ANNUAL ESTIMATES OF NATURAL GAS RESERVES FOR PERIOD DEC. 31, 1945 TO DEC. 31, 1952

(Millions of Cubic Feet—14.65 psia, at 60° F)

	Natural Gas Added During Year						
Year	Extensions and Revisions	Discoveries: New Fields, New Pools in Old Fields	Total of Discoveries, Revisions, Extensions	Net Change in Storage	Net Production During Year	Estimated Proved Reserves as of End of Year	Increase Over Previous Year
1945	0	0	0	0	0	147,789,367	0
1946	a	a	17,729,152	a	4,942,617	160,575,901	12,786,535
1947	7,570,654	3,410,170	10,980,824	a	5,629,811	165,926,914	5,351,013
1948	9,769,483	4,129,089	13,898,572	51,482	6,007,628	173,869,340	7,942,426
1949	8,061,429	4,612,870	12,674,299	82,746	6,245,041	180,381,344	6,512,004
1950	9,172,381	2,877,351	12,049,732	54,301	6,892,678	185,592,699	5,211,355
1951	13,013,606	3,039,385	16,052,991	132,751	7,966,941	193,811,500	8,218,801
1952	8,934,470	5,411,043	14,345,513	198,850	8,639,638	199,716,225	5,904,725

a Not estimated.

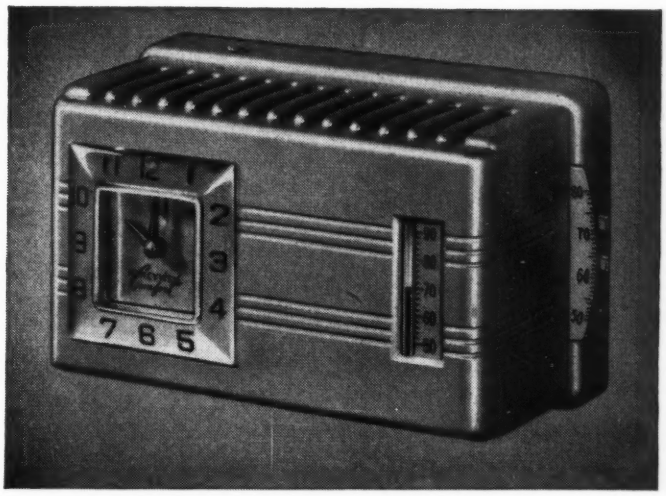
Why more Honeywell Controls are used in Consolidated's territory than any other make

Consolidated, like all utilities, is vitally interested in keeping its gas home-heating customers satisfied. To do this, Consolidated makes it a policy of recommending equipment with a proved performance record.

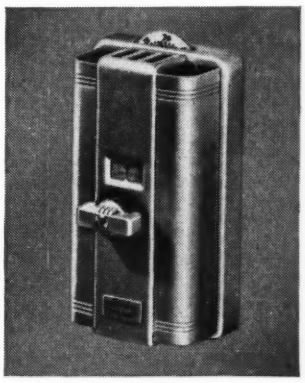
High on this recommended list are Honeywell controls—like the famous Honeywell Thermostats shown on this page. In thousands of Baltimore homes they are performing accurately, dependably and with a minimum of service or maintenance—building customer good will and satisfaction in the process.

As one Consolidated executive stated recently:

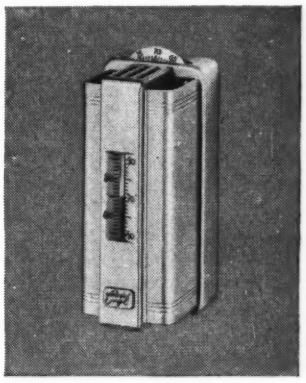
> "We never hesitate to recommend Honeywell controls. Our experience over the years proves conclusively that the record of Honeywell controls for long, trouble-free service is outstanding."



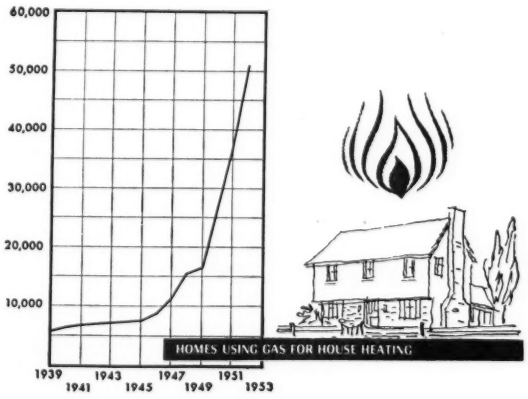
Honeywell Chronotherm—the famous electric clock thermostat that automatically turns the heat *down* at night—and up in the morning.



Honeywell Time-O-Stat—provides automatic morning pick-up plus accurate temperature control.

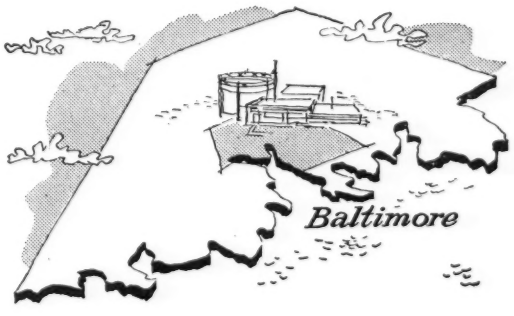


Honeywell Comfort Thermostat—is durable, dependable and highly sensitive. Famed for trouble-free operation.



How gas home heating sales were increased over 200% since Jan. 1, 1950

When Natural Gas was brought to Baltimore early in 1950, less than 17,000 of Consolidated's 270,000 residential gas consumers were heating their homes with gas. An aggressive promotional campaign was started to increase the use of Natural Gas as a home-heating fuel, which proved most successful. Today, Natural Gas is being used in over 50,000 homes. Included are new homes—over 80% selected gas in the last two years.



Consolidated promotes area development

Consolidated, a pioneer among utilities in promoting new industry to further economic progress, made the famous "Industrial Survey of Baltimore" in 1914—recognized as the first study of its type ever made. Since then, continuing and expanding efforts have been directed toward new industrial acquisitions, with attending commercial and residential growth, and toward improved farm methods in the rich agricultural district it serves.

For illustrated literature and application data about the Chronotherm or any other Honeywell control, call your local Honeywell office. Or write Honeywell, Dept. GS-4-39, Minneapolis 8, Minnesota.

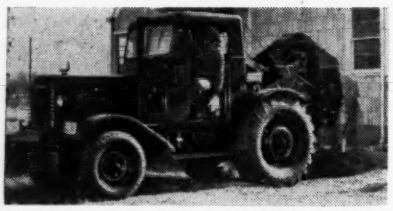
MINNEAPOLIS **Honeywell**

First in Controls

H HONEYWELL

New Products and Trade Literature

To secure further information on products or new literature, simply fill out the coupon and mail, indicating by number the information or literature needed.



1 Ditcher

Featured in the new Barber-Greene "Runabout" ditcher is a complete fluid coupling and a special curved-tooth bucket line to increase digging efficiency and assure longer digging tooth life.

A heavy-duty Chrysler industrial engine transmits it power through a fluid coupling to the special Hydra-crowd transmission, thereby protecting the digging mechanism by a constant hydraulic cushion that eliminates shocks and surge loads, and permits application of full engine horsepower to the task of digging. If an obstruction presents too much resistance to the bucket line, the coupling slips and the bucket line stops.

The range of forward speeds while digging is from zero to 16 ft per minute. Hydra-crowd is controlled by a simple faucet-like valve. Other improved features include the counter-balance valve that eliminates runaway tendencies and the curved digging teeth which are said to have longer life, easier replacement, and more effective discharge. A new 8-page folder describes the Runabout in detail.

Barber-Greene Co.

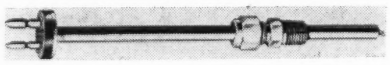
2 Odorants

Two new gas odorants have been announced by Sharples. Spotleak 1008 is a liquid-injection type odorant with a high odor intensity that makes possible the use of smaller quantities. Spotleak 1009 is a universal odorant and can be used for either evaporation bypass or liquid-injection odorization.

General availability of Pentalarm 1004, a liquid-injection type odorant, has also been announced. Due to its amyl mercaptan content, odor level can be recorded with reasonable accuracy by means of the colorimeter developed by Sharples.

Sharples Chemical Inc.

■

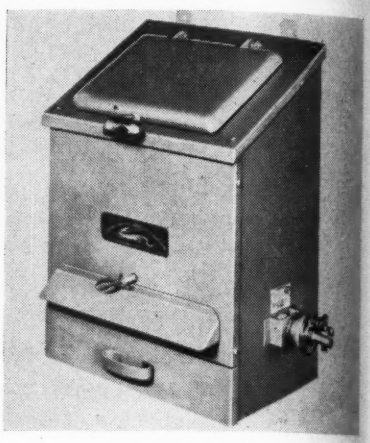


3 Tube Fittings

Standard Swagelok tube fittings are now available in fractional sizes for holding thermocouples. These connectors are bored completely through at one diameter.

Thermocouples or dip tubes can be handled with the connections that are furnished in a wide variety of sizes from ⅛-in. and up in brass, aluminum, steel, stainless steel, and monel.

Crawford Fitting Co.



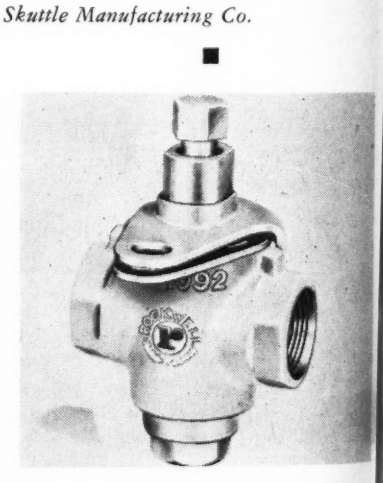
4 Incinerator

The new "Hungry Dragon R" incinerator has been designed with a capacity adequate for a family of two to six. The AGA-approved, gas-fired unit is recommended for continuous low flame operation. Heat of the flame dehydrates the rubbish and fires it when dry.

The incinerator may be hung on the chimney or mounted on a stand on the basement floor. A flue draft of .03 in. or more is sufficient.

Skuttle Manufacturing Co.

■



5 Service Cock

A new lubricated, tamper-proof service cock for the gas industry has just been introduced by Rockwell. Rated at a working pressure of 125 WOG, the cock is available in sizes of ¾-in. through 1½-in.

To resist tampering, a drive screw in the

Mail this Coupon

for NEW PRODUCTS INFORMATION

COPIES OF NEW LITERATURE

GAS, 198 S. Alvarado St., Los Angeles 4, Calif.

4/53 Fill in numbers of items in which you are interested.

No. ..... No. ..... No. ..... No. .....

No. ..... No. ..... No. ..... No. .....

NAME AND TITLE.....

FIRM'S NAME.....

ADDRESS.....

CITY.....ZONE.....STATE.....

Another First . . .

TITAN TANKMASTER

WATER HEATER CONTROLS

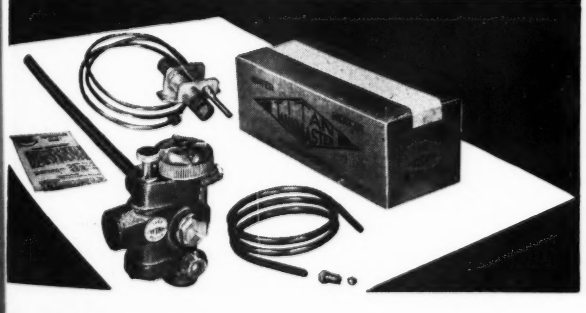
WITH

*Electro-Tin Finish

*Slight Extra Cost

TITAN TANKMASTER is supreme among water heater controls. Engineering perfection combined with precision production have created a control that is SIMPLE, SAFE, SURE AND ECONOMICAL IN GAS CONSUMPTION. Features include—Precision machined metal to metal valve and seat — Larger capacity — Improved Snap-Action mechanism with true snap-action from full close to full open and vice versa — Accurate thermostatic control — Safe lighting — 100% Safety pilot — AGA Listed — Furnished with or without pilot gas filter — and NOW Electro-Tin Finish.

Both Brass and Electro-Tin Finish TITAN TANKMASTERS are available in complete Installation Kits as illustrated below.



Always first in PERFORMANCE . . .

Now first in APPEARANCE!

With ELECTRO-TIN FINISH, TITAN TANKMASTERS have a strikingly new and thrilling beauty, easy upkeep and a trim and sleek style that blends harmoniously with gleaming snow white modern water heaters and home decor . . . . Since water heaters are now prominently placed in utility rooms and kitchens this improved appearance is a MUST.

Other **Electro-Tin Finish** advantages are — Its resistance to tarnish because it resists atmospheric fumes . . . It reduces rust and corrosion to a minimum . . . With the variety of chemicals in water in various parts of the country this protective coating prevents chemical reaction and assists as a safeguard to health — like the tin coating on a food container.

Insist on Titan Tankmaster Controls with **Electro-Tin Finish** . . . They are backed by a 20-year tradition of precision craftsmanship . . . Made for use with Natural, Manufactured and Bottled Gas.

THE TITAN VALVE & MANUFACTURING COMPANY

9913 ELK AVENUE • CLEVELAND 8, OHIO

stop collar on the upper shank prevents removal of the stop collar and the blind drive pin in the adjustment collar at lower end of plug holds adjustment collar fast. Two grooves connected to annular grooves above and below the plug ports carry a film of lubricant to all areas of the seating surface, providing a positive seal whether the service cock is open or closed. "O" rings at both upper and lower ends of plug provide additional insurance against leakage.

Rockwell Manufacturing Co.

■

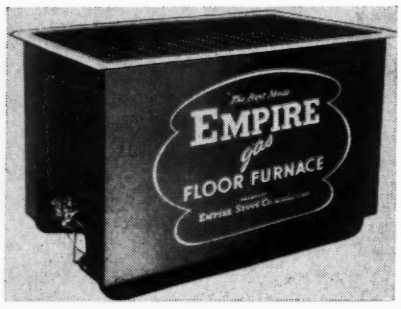
6 Pipeline Filter

Four new small pipeline filter models, designed for installations requiring only 40 psi maximum pressures for compressed air or gas, feature one-bolt accessibility for quick inspection and cleaning without removing filters from the line.

The new Dollinger filters are manufactured in two sizes and each size can use either absorption pad media or the original Dollinger radial fin inserts. Sizes are 3½ in. in diameter and a length of 6½ in., and 3½ in. with a 10-in. length. The AA Series of filters with absorption pad media removes last traces of oil and water vapor from lines. The CH series with radial fin inserts is designed to rid lines of dirt and pipe scale.

Dollinger Corp.

■



7 Floor Furnace

A new line of floor furnaces has been announced by Empire Stove Co. They are available in four models: 25,000, 35,000, 50,000, and 70,000 Btu input for all gases. The line is of the shallow type with the new Empire vertical Thriftmatic burners.

The company is also producing a new line of recessed heating units available in 25,000 Btu input single wall and 50,000 Btu input dual wall models featuring a warm air grill that increases the amount of radiant heat.

Empire Stove Co.

Trade Literature

8 Fitting Catalog

Now available is a 40-page catalog of Dresser fittings for gas service connections. The three-color, fully illustrated manual features a special section showing 50 reproductions of actual standards and instruction sheets showing how gas companies use Dresser gas service fittings.

Dresser Manufacturing Div.

■

9 Illustrated Leaflets

Two illustrated leaflets entitled "Here Are the Answers on Flexible Carlon Plastic Pipe" and "Here Are the Answers on Rigid Carlon Pipe" are now available. Installation procedures and specifications are presented together with informative answers to the 22 most frequently asked questions about the company's flexible and rigid pipe.

Carlon Products Corp.

■

10 Pot Furnace Catalog

Eclipse gas-fired pot furnaces are described in a new catalog. The furnaces, for hardening and drawing in lead and heat treating salts, are discussed in detail with cutaway drawings and photographs. Complete specifications are also presented.

Eclipse Fuel Engineering Co.

■

11 ACF Pamphlet

American Car & Foundry has just issued a revised pamphlet outlining the company's list of products. The pamphlet also contains a list of catalogs that are available.

American Car & Foundry Co.

■

12 Meter Data Sheet

The operation and application of the Brown Btu meter, which simultaneously records differential temperature and flow of a liquid and provides direct reading of Btu, is described in a new data sheet. Illustrations are also included.

Minneapolis-Honeywell Regulator Co.

■

13 Compaction Bulletin

Detailed information and production data for figuring work schedules and costs on soil compaction jobs are contained in a new bulletin covering the use of the Barco portable gasoline Rammer for tamping fill or backfill in restricted areas. The six-page bulletin presents information on the use of soil compaction to attain greater permanence, lower costs, and earlier completion dates.

Barco Manufacturing Co.

■

14 Temperature Manual

Basic principles of industrial temperature control are presented in a new edition of "The Design and Process Engineers Guide to Industrial Temperature Measurement and Control." The 24-page two-color manual discusses the eight ways of responding to temperature; the five ways of putting that response to work; and the nine basic Partlow instruments types.

Partlow Corp.

■

15 Technical Data Card

A new technical data card from Babcock & Wilcox discusses Croloy 5, one of the alloy tubing steels widely used in elevated temperature service. Included in the bulletin are data on mechanical properties, creep strength, physical properties, welding, fabrication, and heat treatment.

Babcock & Wilcox Co.

■

16 Taylor Bulletin

Latest developments in 6-in. dial indicators for temperature, pressure, and load applications are described in a new 24-page bulletin released by Taylor Instrument. Fully illustrated, the bulletin contains information on features, dials and scales available, together with reference material on different types of actuation.

Taylor Instrument Companies

■

17 Hose Catalog

Types, possible uses and applications, installation data, and other pertinent information on three new types of spiral wire reinforced flexible hose are presented in an illustrated catalog published by the manufacturer of Flexaust.

American Ventilating Hose Co.

■

18 Condensed Catalog

McDonnell boiler water feeders, low water fuel cutoffs, pump controls and relief valves are covered in a new condensed catalog and price list. The eight-page catalog presents information to simplify selection of proper equipment and contains discount sheets on the products described in the catalog.

McDonnell & Miller Inc.

it's 5 to 1

ORONITE HAS A GAS ODORANT TO MEET YOUR EQUIPMENT AND COST REQUIREMENTS

Why not talk over your odorization requirements with a leader in this industry? Oronite will place at your disposal the long experience of gas odorant specialists.

In Oronite's group of five products you will find the *right odorant* for your operating conditions, your equipment and your cost requirements. You can choose from three of the cyclic sulfide type and two mercaptans.

Just contact the Oronite office nearest you for full information and assistance.

ANNOUNCING!

1. Oronite ALERT 80

The improved Alert Gas Odorant

As the requirements for a gas odorant change, so must a gas odorant change to meet today's long-line, high-pressure transmission systems. Alert 80 is a selected and blended group of mercaptans with new blending and balancing to give better, full-range volatility and stronger initial "punch". Alert 80 has been "system-tested" by two large utilities for over a year and has met every test. Get the full story. Write or phone the Oronite office nearest you.

2. L-P Gas Odorant

A mercaptan type odorant, having a close boiling range, made especially for L-P Gas but works equally well in natural gas.

3. Calodorant "C"

Calodorant "C" is a completely stable cyclic sulfide that gives good odorization at ½ pound per MMCF of gas. Extremely low sulfur contribution practically eliminates pilot light failures due to corrosion. Will not condense in high pressure lines; vaporizes easily under low pressure.

4. Calodorant "C" Special

Compounded to give effective odorization at 1 pound per MMCF of gas. Recommended for use in systems whose odorizing equipment operates best at this level of odorization.

5. Calodorant

The first commercially made odorant and still the most widely used. It is the cyclic sulfide type, low in cost and easy to use. Two gallons or less per MMCF of gas produce a pungent, true "gassy" odor that gives adequate warning without "fatiguing" quickly.

ORONITE
CHEMICAL
COMPANY

THE NAME CHEMICALS

Oronite Odorometer!

"A complete room test in a package"

The newly developed Odorometer does your room testing work for you. For a demonstration or bulletin, contact any Oronite office.

ORONITE CHEMICAL COMPANY

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MERCANTILE SECURITIES BLDG., DALLAS 1, TEXAS

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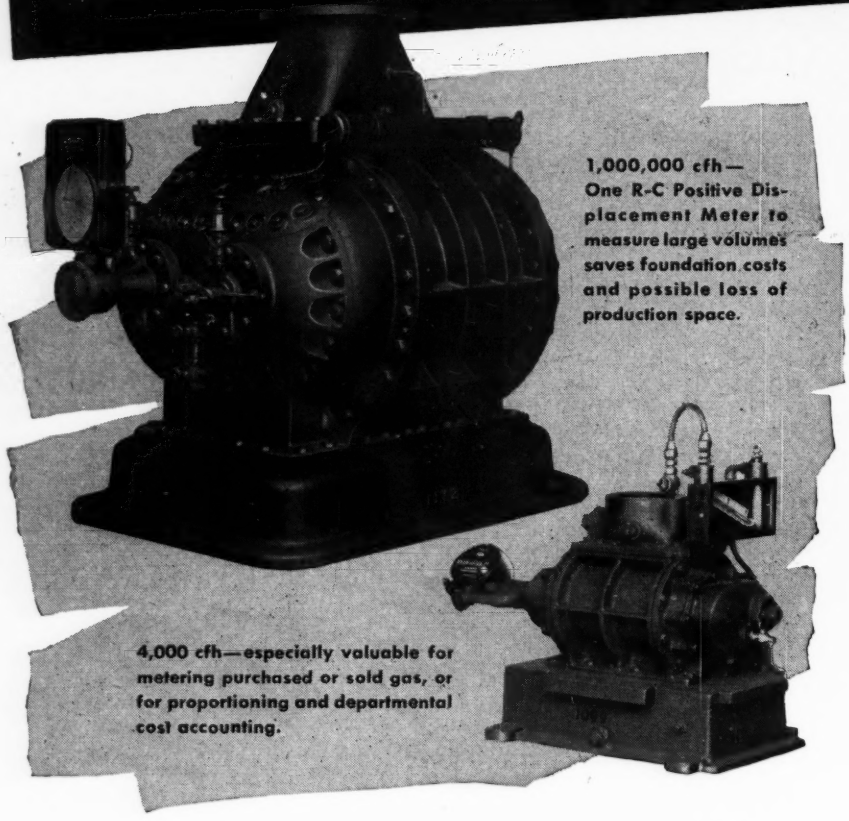
CALL ON THE "Specialists" FOR ACCURATE METERING


1,000,000 cfh—
One R-C Positive Displacement Meter to measure large volumes saves foundation costs and possible loss of production space.
4,000 cfh—especially valuable for metering purchased or sold gas, or for proportioning and departmental cost accounting.

The successful performance of Roots-Connersville Positive Displacement Meters has long been proved by large and small industrial plants and public utilities. These users rate them high in such basic essentials as:

Accuracy—not affected by pressure, wide ranges in loads or other variables. Absence of valves, vanes and other small parts insures "cash register" accuracy over years of use.

Capacity—from 4,000 cfh to 1,000,000 cfh in one unit, with ample ability to absorb overloads.

Compactness—smallest made for industrial use in foot-for-foot of capacity. Can be located in otherwise unusable space, thus saving production areas.

Almost a century of experience in handling gas and air, exclusively, goes into the design and construction of R-C Meters. They're part of the comprehensive line of blowers, exhausters, gas and vacuum pumps and related equipment, which are the products of R-C Specialists, and which are in widest use in industry.

A new bulletin, M-152, gives complete data on R-C Meters, including a handy selection table which simplifies your choice of the right meter to suit your specific application. Your copy will be sent on request.

ROOTS-CONNERSVILLE
Exclusive Specialists in Handling Gas and Air

ROOTS-CONNERSVILLE BLOWER A DIVISION OF DRESSER INDUSTRIES, INC.
534 Oregon Ave. • Connersville, Indiana

Thermally Thinking

Continued from page 32

rejected without prejudice to a new filing eliminating any "speculative or indefinite" factors.

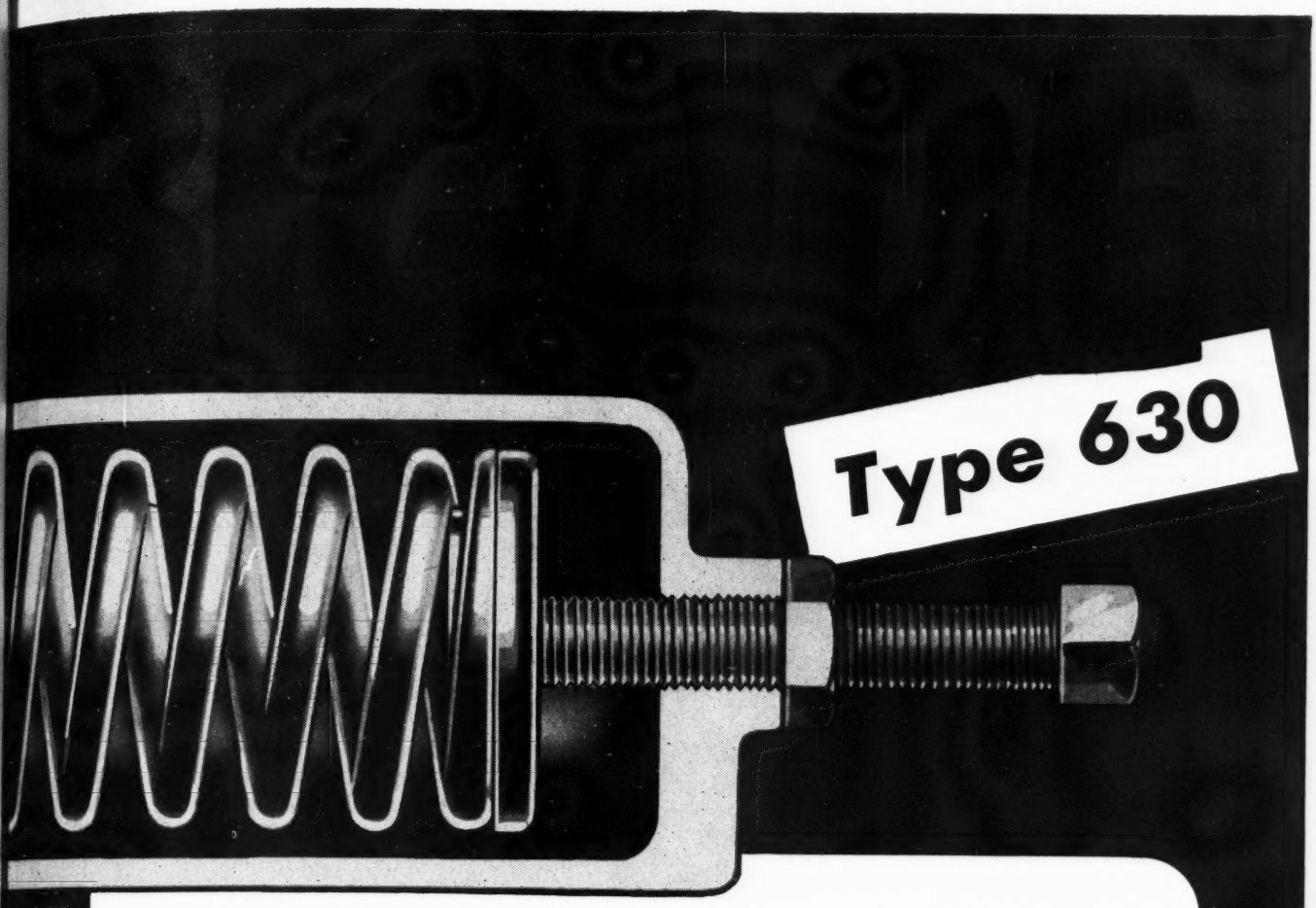
United did file for an increase, incidentally—and on May 29. Although the application was returned June 27 for deficiencies in form, it was eventually docketed and ordered suspended for the five-month period, and allowed to go into effect under bond Jan. 3, 1953.

Meanwhile, Mississippi applied on June 24 for rehearing on the ground that the commission was required to grant a hearing and had no right to reject the application summarily. No action was taken, so Mississippi took its case to court.

Said the court, in part:

"Admitting (that factors other than anticipated future rate increases of Mississippi's suppliers are the stated basis for most of what Mississippi proposes), the commission argues in effect that it is asking too much to expect the commission, after full hearing at which all relevant facts may be adduced and the parties have had opportunity to analyze the evidence and present arguments as to the applicable law, to sort the good from the bad. Yet, precisely that is a principal purpose of the hearing and a major responsibility of the commission.

"Section 4(e) of the Natural Gas Act makes special provision for the familiar situation in which, pending administrative hearing and decision, a public utility may increase its rates subject to a possible requirement of future refunds. The commission, upon completion of hearing and decision, is empowered, in the language of the statute, 'to order such natural-gas company to refund, with interest, the *portion of such increased rates* or charges by its decision found *not justified*.' [Italics added.] This provision clearly demonstrates, if demonstration be needed, that Congress contemplated that there would be cases in which, after hearing, some part of a requested increase would be approved as justified even though some other part would be



The gas man's First Choice for pounds to pounds service

Fisher's famous Big Joe Type 630 is the best regulator the industry has for rugged high pressure jobs. It's ideal for Farm Taps, Small Border Stations, and Industrial Installations. For completely dependable service, there is no regulator like the Big Joe— it's backed by thousands upon thousands of installations along the major pipe lines of this country.

Available in 1" and 2" sizes for inlet pressures up to 1000 PSI and outlet pressures 5 PSI to 200 PSI.

WRITE FOR BULLETIN P-10A

FISHER GOVERNOR COMPANY

MARSHALLTOWN, IOWA

FISHER

"Yes, You Still Have Time"
to sign up for a
HEATH
LEAKAGE CONTROL
SURVEY

Milt Heath advises . . .
"Sign up NOW for your 1953 HEATH GAS LEAK LOCATION SURVEY"

We are in the early stages of setting up Spring and Summer survey schedules. As it is extremely important that the time of our trained consultants be plotted well in advance, we urge you to take prompt action. Heath Consultants with their long experience, specialized equipment and latest methods will make complete and accurate gas leak location surveys of your property this season. Heath locates leaks, classifies them as to size and importance and furnishes detailed reports so you reduce leakage to the minimum. Write us at once.

HEATH reports are highly rated by your legal and claims departments and by your insurance company. HEATH is the only nationally recognized leak location agency. Approximately 500 gas properties in some 40 states and in five provinces of Canada use Heath Leakage Control Surveys . . . and Heath clients renew their contracts year after year.

You too can save thousands of dollars annually, reduce hazards, and maintain a maximum SAFETY FACTOR. Decide *today* to have a Heath Leakage Control Survey on your property!

HEATH
LEAKAGE CONTROL SURVEYS

You can't sell gas that leaked out!

Write, Wire, or Phone for Complete Information

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572 Washington Street, Wellesley 81, Massachusetts
Midwestern Office—Richmond, Michigan

found inadequately supported and disallowed."

The court agreed that FPC's work load may be too large for its present staff to handle, but decided that such a procedure as was followed in this case was an unfair method of reducing it.

The commission was ordered to accept the papers immediately for refiling and permit Mississippi to file for the increase under bond.

Open-door policy

The province of Saskatchewan, younger brother (oil-and-gas-wise) of Alberta, is learning rapidly, it would appear. Whereas its western relative has proceeded with what might be regarded as too much caution in permitting export of its gas reserves, Saskatchewan is going to open its doors to pipeline companies at the earliest possible moment.

Such assurances were contained in the recent pronouncement of policy by the provincial government. Estimating that it now has reserves of no less than 870 billion cu ft, and optimistically lumping in some less-well proven areas with promising shows, Saskatchewan thinks it can "safely estimate" that "indicated" reserves now total 1 trillion.

The doors may be opened tomorrow, in fact, to any interprovincial pipeline company that has these two keys:

The guarantee, for the duration of the pipeline's life, of supplies of natural gas at reasonable rates sufficient to meet the provincial requirements.

The further guarantee of an adequate share of the export market for natural gas produced in Saskatchewan.

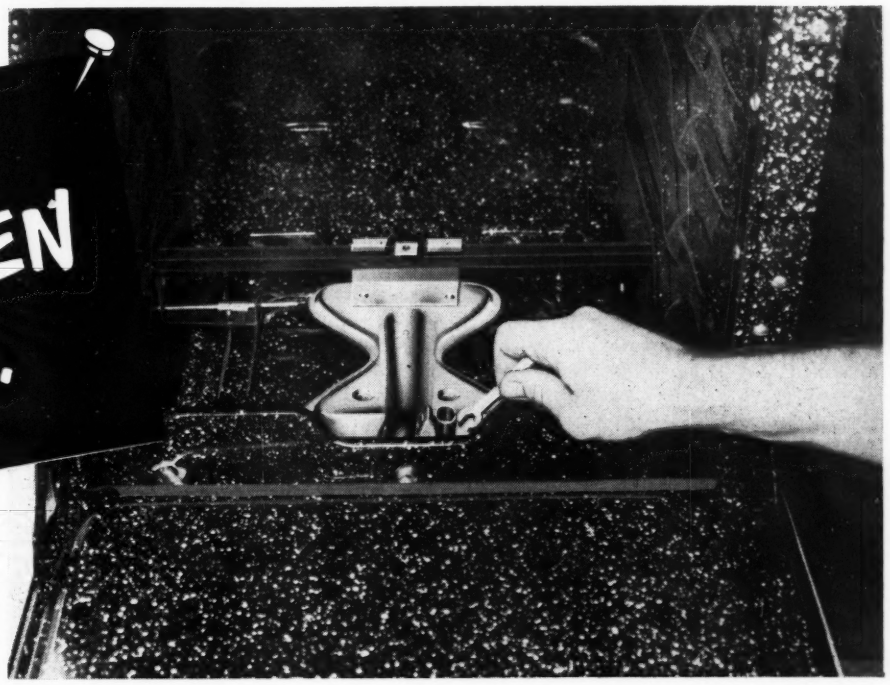
However, if such guarantees are not forthcoming, the government will still permit export on this basis:

"The export from the province of natural gas produced in the province will be allowed after the establishment of a proven reserve for provincial use of 1 trillion cu ft, such provincial reserve to be increased by 50% of reserves proven over 1 trillion cu ft, and 25% of reserves proven over 3 trillion cu ft.

"The province of Saskatchewan will reserve the right to restrict the export from the province of natural gas produced in the province in the event that the provincial reserve will be reduced by such export, or at any time it is determined that the production allowable for any one year is insufficient to meet provincial demand."

According to market studies, the

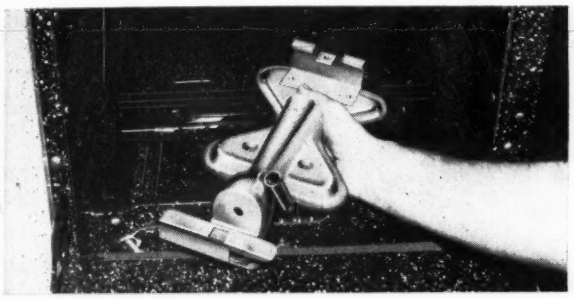
FOR SERVICEMEN ONLY...



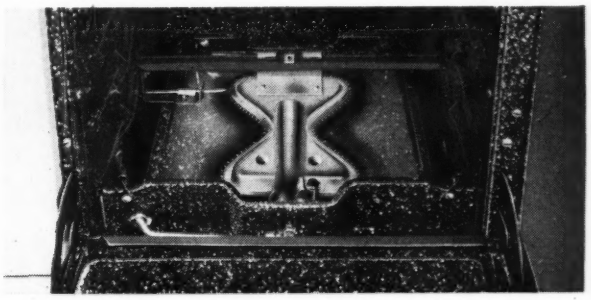
Top Brass

Pass it on

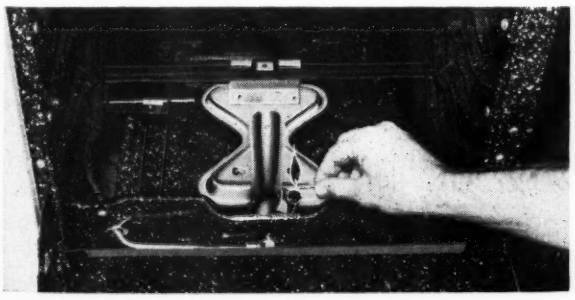
WAY OUT FRONT At last, here is an oven burner you can adjust without burning your hand or elbow. EquaFlo, another sensational "first" for Hardwick, provides a fitting at the front for adjustment of air and gas. A simple twist of the wrist adjusts the burner easily and with absolute accuracy. You'll say—"Why didn't someone think of that before?"



EASY TO CLEAN The EquaFlo burner fits rigidly into place, thanks to its special flange, yet it can be lifted out easily—just unhook it! Unique construction and placement of parts make it extremely convenient to clean.



ABSOLUTE HEAT BALANCE The new EquaFlo is super fast, directs the live gas flame over the whole broiler area and heat over the entire oven surface. Complete heat distribution—more complete than ever before—is provided.



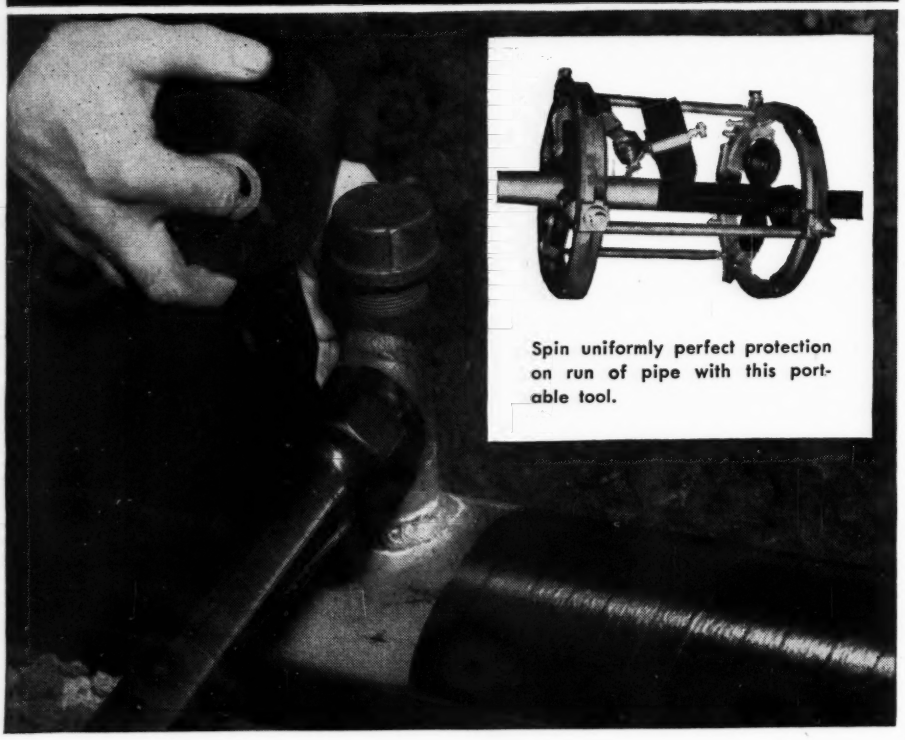
IMPROVED MATCH LIGHTER The match lighter on the EquaFlo burner is in easy reach directly in the front of the oven. Lights instantly even when gas is barely turned on. Non-clog.

HARDWICK

Bakes and Broils like you have never seen before

HARDWICK STOVE COMPANY • CLEVELAND TENNESSEE

TRY DRESSERTAPE*



Spin uniformly perfect protection on run of pipe with this portable tool.

Fast, easy, effective CORROSION PROTECTION!

No matter who does the job, *all* your underground pipe and joints can now have *full, permanent protection* against corrosion. Dressertape—the high dielectric plastic tape—is the answer. Any crew can master the easy application techniques in minutes, save expensive man hours and cut over-all costs on every job. Try Dressertape yourself!

LOOK AT THESE OUTSTANDING DRESSERTAPE ADVANTAGES!

- Uniform coating—top, bottom and sides.
- Easy, clean to apply—sticks at a touch, no heating equipment required.
- Safe to use—no burns, no fumes.
- Conforms to irregular surfaces—especially over fittings on service lines.
- Immediate backfill—no waiting.
- Exceptional electrical properties—dielectric strength: 10,000 volts; insulation resistance: 100,000 megohms.
- Lasting protection against water, oil and soil chemicals—equal to, or exceeding, yard or mill-wrapped pipe.
- Available in widths from ¾" to 6".

Send today for our new, fully illustrated booklet "Dresser Taping Fundamentals". Anyone can master Dresser's laboratory and field proved methods in minutes.

*Dressertape is a trade-mark of Dresser Manufacturing Division

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government estimates that a reserve of between 700 and 800 billion would be sufficient to meet "foreseeable" requirements for 20 years. The two-way policy provides an extra margin of safety, but not an insuperable hurdle for prospective gas exporters.

Says the provincial government:

"This policy will give to producers that incentive required to go out and discover and develop the province's natural gas resources."

End of story

The ruckus that was kicked up several months ago by the Associated Plumbing, Heating & Piping Contractors of New Mexico over Southern Union Gas Co.'s activities in the merchandising field (see *GAS*, January, p. 24) has long since been settled, quietly. The settlement wasn't the stuff that makes headlines: it was merely a melting away of differences on a high level of business statemanship.

No magic or supernatural intervention was called forth at the series of conferences which brought about the settlement. Nor was there any basic change in policy by the utility. The real accomplishment was in the utility's ability to make the association understand its position.

Said the association's president, L. Mark Gray, in a letter to members:

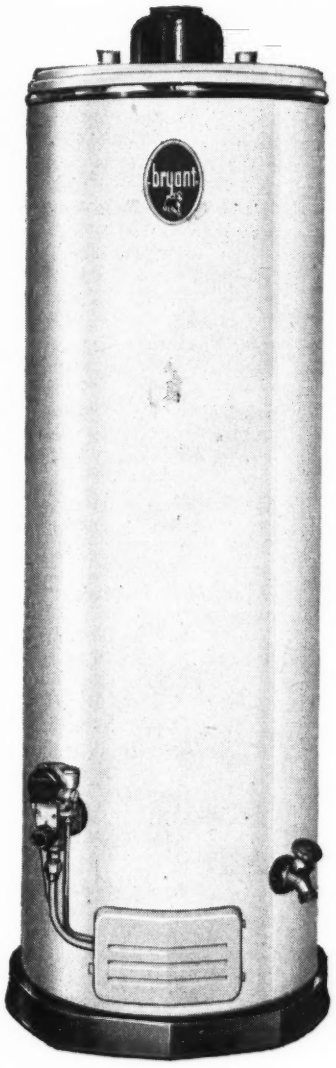
"The conferences just concluded with the gas company have resulted in our obtaining detailed information with reference to Southern Union's merchandising program and plumber-dealer policies. This information clearly indicates that our major misgivings have primarily resulted from a lack of complete and accurate information . . .

". . . we are confident that had these conferences been held some months ago, the litigation would not have occurred . . . As a result of these conferences a coordinating committee has been set up . . . (which) will hold regular meetings to discuss mutual problems, promote better understanding, and exchange mutually beneficial ideas.

"Southern Union will continue its merchandising program. We are convinced that this activity will be conducted on a fair, equitable, and helpful basis."

Thus was ended on a note of amity and understanding an episode that might have split forever two allies who need each other like bread needs butter—the utility and its dealer.

its product prestige means... PLUS PROFITS FOR YOU!



Bryant *De luxe* is available in 20, 30, 40 and 50-gal. sizes. Features exclusive *Link-Trap* segmental baffle; exclusive streamlined downdraft diverter; exclusive enamel aeration plate; *Protect-O-Rod* magnesium anode.

bryant DE LUXE

The Automatic Gas-Fired Water Heater with Top-Ranking Quality, Dependability, Trouble-Free Operation

Profit in your water heater selling is more than dollars and cents margin. It's customer satisfaction . . . repeat business . . . and *most important* . . . the absence of service call-backs. For top profit, you must first have the product that offers features people want . . . automatic operation . . . dependable service . . . easy temperature selection. You have them in the Bryant *De luxe* Water Heater.

But that's not all! The Bryant *De luxe* has the *built-in* quality that means fewer customer call-backs for service—less profit-taking service expense for you. Material and workmanship must conform to top construction standards.

That's why the Bryant *De luxe* is backed by the Bryant 10-Year Warranty . . . the plan that protects your customer's investment . . . offers *you* an extra sales clincher. And . . . you get a warranty replacement plan that gives you extra sales at full profit, too!

So . . . if you want customer satisfaction *plus* profitable sales-installations, the Bryant *De luxe* Water Heater is your *prestige product for plus profits.* For complete details, call the Bryant Distributor near you or write: Bryant Heater Division, Department 262, Affiliated Gas Equipment, Inc., 17825 St. Clair Ave., Cleveland 10, O.

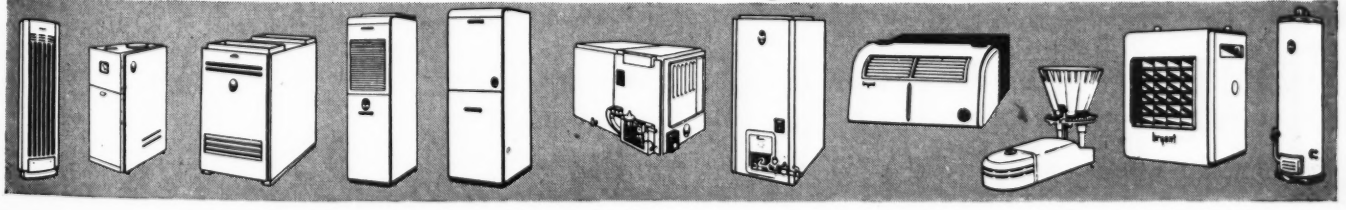
bryant®

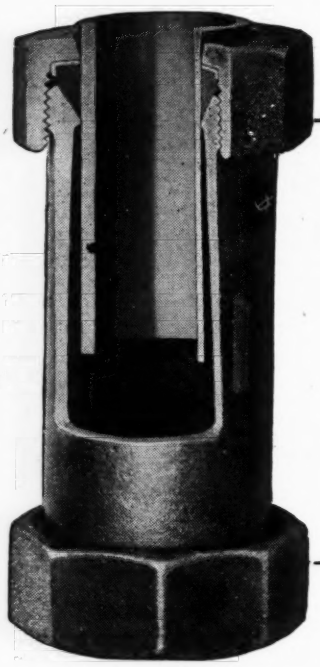
HEATING

AIR CONDITIONING

WATER HEATING

YOUR SINGLE SOURCE FOR EVERYTHING IN GAS HEATING AND AIR CONDITIONING EQUIPMENT





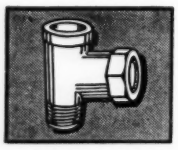
NORMAC

Couplings, Sleeves and Fittings

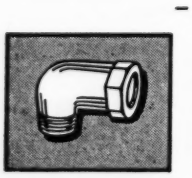
for maximum deflection, ease of "stabbing," complete confinement of the rubber!

So close are "Normac" rubbers confined at the gasket tip that possibility of flow is reduced almost to "nil." These couplings, sleeves and fittings . . . approved by gas utility men across the country for their time-saving features, ease of handling and dependable service . . . are available in a complete range of sizes. Made from air furnace malleable iron they provide greater wall thickness than pipe on which used.

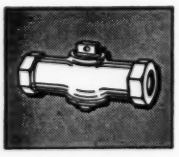
NORMAC COUPLINGS are made with 5" centers in all sizes. NORMAC SLEEVES are identical in design except that they are made with 10" centers. Nuts and gaskets are interchangeable.



Compression-End Service "Tee"—First fitting of this type ever produced with full coupling depth and special threads on male end to prevent dropping into old hand taps when used to replace standard threaded fittings.



Compression-End Service "Ell" — Extra depth makes it possible to "stab" pipe into stops and without measuring, pull back a safe distance to allow ultimate deflection eliminating possibility of strain against tap in main.



Compression-End Iron Body Brass Core Service Stopcocks—End the necessity of threading on the job plus the elimination of the threads themselves—combining all the advantages of NORMAC COUPLINGS and the best in stopcock design. 2½" coupling depth on each end.

Normac Brass Fittings Developed in 1939 for Use with Copper Tubing—Our complete line of brass fittings can be used either on new installations or where copper is run through old steel pipe in large or small openings. The center to end dimensions of NORMAC TEES correspond with old malleable iron fittings. This feature is extremely important in the use of these fittings in one foot openings where the tubing must line up with the steel which has been removed.

Write for the NORMAC CATALOG of Gas Distribution Equipment

NORTON-McMURRAY MFG. CO.

122 SOUTH MICHIGAN AVENUE - - - CHICAGO 3, ILLINOIS

Couplings • Motor Bars • Sleeves • Cocks • Bell Joint Clamps • Service Tees & Ells

CALENDAR

April

7..GAMA Regional Meeting — Statler Hotel, St. Louis.

7-8..AGA Research and Utilization Conference — Hotel Statler, Cleveland.

9..GAMA Regional Meeting — Read House, Chattanooga, Tenn.

8-9..PCGA Accounting Section — Phoenix.

13-15..AGA Sales Conference on Industrial and Commercial Gas —Hotel Warwick, Philadelphia.

13-15..AGA Accounting Section, Purchasing and Stores Conference — Shroeder hotel, Milwaukee.

13-16..AGA Distribution, Motor Vehicles and Corrosion Conference—Hotel Sherman, Chicago.

15-16..PCGA Sales Section, Home Service Workshop — Santa Barbara, Calif.

16-18..Florida-Georgia Gas Assn.—Hotel Biltmore, Palm Beach, Fla.

20-22..National Conference of Electric & Gas Utility Accountants—Hotel Sherman, Chicago.

21-23..AGA Subcommittee No. 8 on Gas Transmission & Distribution Piping—Santa Monica, Calif.

21-23..Southwestern Gas Measurement Short Course—University of Oklahoma, Norman.

23-24..Indiana Gas Assn. Annual Convention — French Lick Springs hotel, French Lick, Ind. (Tentative).

27-29..Mid-West Regional Gas Sales Conference — Edgewater Beach hotel, Chicago.

28-29..PCGA Technical Section, Distribution — San Jose, Calif.

29- 1..Natural Gasoline Assn. of America Annual Convention —Rice hotel, Houston.

29- 1..New England Hotel & Restaurant Show—Statler Hotel, Boston.

30- 1..AGA Transmission and Storage Conference—Edgewater Beach hotel, Chicago.

May

4-5..AGA Eastern Natural Gas Regional Sales Conference — William Penn hotel, Pittsburgh.

4-6..LPGA Annual Convention—Conrad Hilton hotel, Chicago.

4-8..AGA Industrial Gas School—Sheraton-Cadillac hotel, Detroit.

5-6..Gas Hydrate Control Conference—University of Oklahoma, Norman.

6..New Jersey Gas Assn. Home Service Conference — Military Park Hotel, Newark.

7- 8..Public Utilities Advertising Assn. — Hotel Chase, St. Louis.

11-13..Southern Gas Assn. — Jung hotel, New Orleans.

11-15..National Fire Protection Assn. — Edgewater Beach hotel, Chicago.

11-15..34th Annual National Restaurant Convention & Exposition—Navy Pier, Chicago.

12-14..Pennsylvania Gas Assn. Convention.

13-14..PCGA Technical Section, Gas Supply & Transmission — Santa Barbara, Calif.

14-23..International Petroleum Exposition — Tulsa.

15-16..International Gas Union Council Meeting — Paris, France.

20-22..GAMA Annual Meeting — The Greenbrier Hotel, White Sulphur Springs, W. Va.

25-27..AGA Production and Chemical Conference—Hotel New Yorker, New York City.

25-28..Air Pollution Control Assn. Annual Meeting — Lord Baltimore Hotel, Baltimore.

27-29..Short Course in Gas Technology—Texas College of Arts & Industries, Kingsville.

28-29..Natural Gas & Petroleum Assn. of Canada — London, Ont., Canada.

June

14-18..Canadian Gas Assn.—Windsor hotel, Montreal.

22-23..Michigan Gas Assn.—Grand hotel, Mackinac Island, Mich.

29-30..AGA Residential Gas Section, New York-New Jersey Regional Gas Sales Conference — Monmouth Hotel, Spring Lake, N. J.

August

24-26..Appalachian Gas Measurement Short Course — West Virginia University, Morgantown, W. Va.

September

9-11..Pacific Coast Gas Assn. Annual Convention—San Francisco.

10-11..Midwest Gas School and Conference — Iowa State College, Ames.

11..New Jersey Gas Assn. — Spring Lake, N. J.

October

7- 9..NACE South Central Region — Mayo Hotel, Tulsa.

19-21..35th Annual Meeting, American Standards Assn.—Waldorf-Astoria, New York.

19-23..National Metal Exposition—Public Auditorium, Cleveland.

19-23..National Safety Council — Conrad Hilton, Congress, Morrison, and Sheraton hotels, Chicago.

26-28..AGA Annual Convention — Kiel Auditorium, St. Louis, Mo.

November

9-12..API — Conrad Hilton and Palmer House, Chicago.

9-13..National Hotel Exposition — Kingsbridge Armory, New York.

THE NORMAC BELL JOINT CLAMP

A SIMPLE SOLUTION for one of the GAS INDUSTRY'S *most trying problems*

Solves Your Joint Repair Problems • Quick • Easy • Permanent

Installed in small pavement openings. Available in all standard sizes from 3" to 12". A simple set of tools cleans the joint, installs the clamp . . . often in only a quarter of an hour. SAVES TIME. SAVES MONEY and the repair is permanent. Designed for all conditions particularly where pavement repair costs are prohibitive. Such small opening repairs are scarcely noticeable when pavement is replaced.

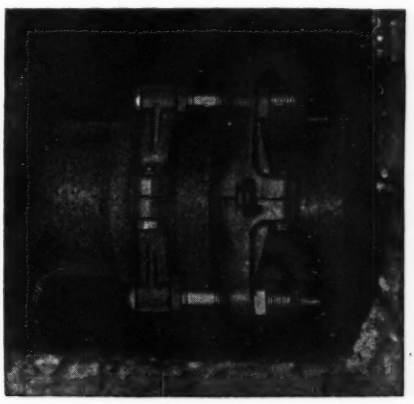
Normac Clamps can be installed in large as well as small openings.

Norton-McMurray hold definite leadership in the development of methods for installation and rehabilitation work through small openings. We welcome the opportunity to help solve a problem you may have—tell us about it.

Write for our catalog describing our complete line of

COUPLINGS . . . FITTINGS . . . SERVICE TEES and ELLS . . . SLEEVES . . . COMPRESSION-END COCKS . . . METER BARS and BRASS FITTINGS for copper pipe.

6 inch Normac Clamp being lowered into hole for installation



6 inch Normac Clamp in service after installation

NORTON-McMURRAY MFG. CO.

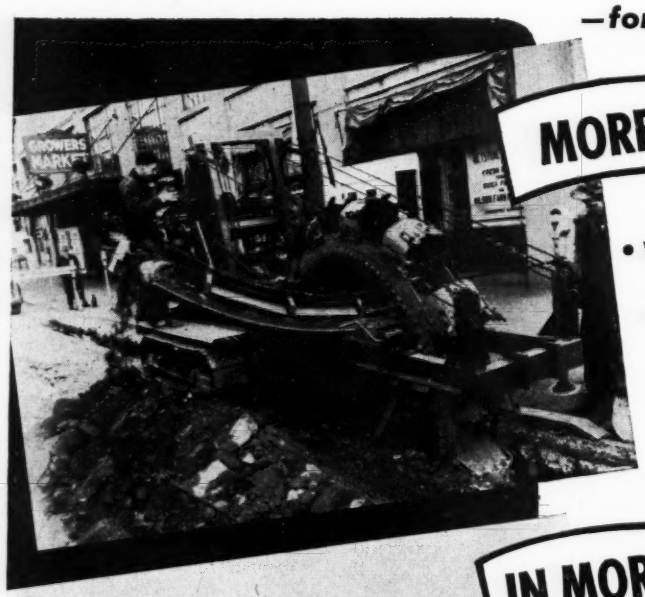
122 SOUTH MICHIGAN AVENUE • CHICAGO 3, ILLINOIS

Method and product covered by U. S. Patents, Nos. 2,163,261 and 2,178,286.

CLEVELAND *Baby Diggers*

"The Gas Industry's Trenchers"

—for over 30 years

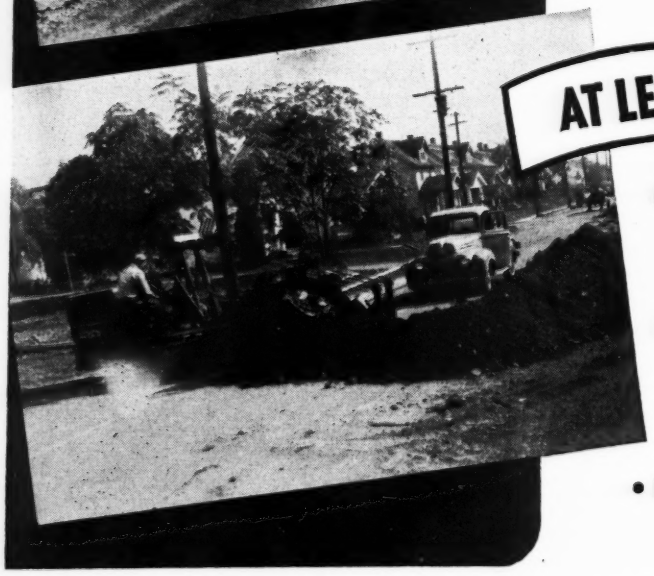


MORE TRENCH

- 4-Speed Main Transmission
- Wheel-Type—Fastest Digging Method
- 12-Speed Crawler Transmission
- Wider Range of Trench sizes
- Generously Powered

IN MORE PLACES

- Compact—Less Than 60" Wide
- Full-Crawler Mounting—Completely Maneuverable
- Fast Boom Hoist
- Shiftable Conveyor
- Truck-Speed Portability—Safer, *Faster* Job Moves



AT LESS COST

- *One* Machine for Mains *and* Services
- Digs All Soils in All Weathers
- Less Property Damage—Crawlers Save Lawns, Walks, etc.
- Unit-Type Construction
- Lower Maintenance Costs
- Longer Life

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THE CLEVELAND TRENCHER CO.

Pioneer of the Modern Trencher

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People

Promotions

Several promotions and the creation of a new executive position in the Texas distribution division of United Gas Corp., Houston, have been announced. JAMES A. WILSON becomes superintendent of Texas distribution operations, the newly created post; C. L. MORGAN succeeds Mr. Wilson as manager of the Houston division; and W. G. MEECE, who has been assistant to Vice President H. P. Carroll, advances to a new position in the income tax department of United Gas in Shreveport. The company also announced the retirement of A. D. KERR as district manager in Marshall, Texas.

C. L. Morgan

J. A. Wilson

RUDOLPH SCHNAKENBURG, vice president in charge of finance and secretary, and JAMES F. DONNELLY, vice president in charge of sales, have been elected to the board of directors of Servel Inc. The Evansville, Ind., firm has also appointed JACK A. SCARLETT to the newly created post of manager of manufacturing engineering.

Servel has also named WILLIAM J. CASHMAN as sales manager of Servel-N. Y., distributing subsidiary in New York City and on Long Island.

Several promotions have been announced by the Peoples Natural Gas Co., Pittsburgh. RUSSELL A. HALL is supervisor of dealer relations, succeeding ARTHUR A. MAUST, who has been named special representative in charge of gas air conditioning. ROMAN L. PIJANOWSKI and J. RICHARD KELSO have been appointed sales promotion representatives.

The following executive changes have been announced by the Public Service Co. of Northern Illinois and its parent company, the Commonwealth Edison Co., Chicago: CHARLES Y. FREEMAN relinquishes the post of chairman and chief executive officer and becomes chairman of the executive committees of both companies; WILLIS GALE is chairman and chief executive officer. JOHN W. EVERS is president of Commonwealth Edison and executive vice president of Public Service. H. P. SEDWICK, president of PSC and executive vice president of Edison. GORDON R. COREY and E. E. LUNGREN are vice presidents of both PSC and Edison. New western division superintendents and their

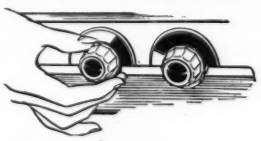
DETROIT JEWEL GAS RANGES

NEW EXCLUSIVE TOP-VUE* OVEN SELLS 'EM!

Lets 'em really **SEE** *what's cookin'*

NEW SIGNA-DIAL

(PAT. NO. D-168684)



Lets 'em really SEE at a glance which burner is turned on!

Two big exclusive firsts on the hottest line in the business. Touch a button—see right into illuminated TOP-VUE OVEN—**from the top.** SIGNA-DIAL shows exact degree to which any top burner has been turned on. Phone, wire or write for details on the line that has everything—PLUS!

*Patents Pending

GARLAND GAS RANGES

DETROIT-MICHIGAN STOVE CO., DETROIT, 31, MICHIGAN

DM PRODUCTS

districts: LEIGHTON C. MEYER, Aurora; C. D. MCEACHRAN, Downers Grove; E. G. WEGENER, Maywood-Elmhurst with RAYMOND E. WACHTER, assistant; F. J. PIANE, LaGrange; W. W. WILCOX, Cicero-Berwyn; JAMES P. BREEN, western service manager.

Executive promotions announced by Michigan Consolidated Gas Co., Detroit, include naming HALE A. CLARK vice president and sales manager, succeeding NEWELL E. LOOMIS, who is retiring after 44 years service. Other changes: KARL E. SCHMIDT, vice president and engineer; WILLIAM A. RHAESA, treasurer, and CARTER E. SHIELDS, controller, both named vice presidents; ELLSWORTH G. REYNOLDS, secretary, succeeding the retiring L. L. SCHLOSSER. ELBERT E. ELLIOT is now first assistant secretary; A. V. BRASHEAR is assistant manager of operations in the Detroit district. BEN E. YOUNG has been elected a member of the board of directors, and HENRY FINK, chairman.

Karl Schmidt

Hale Clark

Carter Shields

W. A. Rhaesa

CLIFFORD E. PAIGE has resigned as a director of Brooklyn (N. Y.) Union Gas Co. Joining the company in 1924 as a vice president, Mr. Paige also served as chief engineer, director since 1932, president from 1935 to 1951, and chairman of the board of directors from 1940 to 1952.

Manufacturers Light & Heat Co., Pittsburgh, has named L. M. BAIR as superintendent of claims and has announced the election of LUKE E. SAWYER, vice president of Babcock & Wilcox Co., as a director of the company.

Surface Combustion Corp., Toledo, Ohio, has named as sales representatives, THOMAS J. BURKE, New York territory; GEORGE C. CLAYTON, New Jersey area; RICHARD L. DEELEY, Pittsburgh; and DONALD A. ALBERT, Iowa-Nebraska.

CHARLES WILLIAMS is heading safety activities of the Gas Service Co., Kansas City, Mo., following the opening of a company-wide safety campaign and contest.

H. M. Hadley
Empire

Charles Williams
Gas Service

HARRY M. HADLEY is the new branch manager in the western Pennsylvania-northern Ohio territory for Empire Stove Co., Belleville, Ill. Recently he was with the Coleman Co.

The responsibilities of L. A. DIXON, Rockwell Manufacturing Co. executive vice president, have been expanded to include jurisdiction over the company's power tool operation, including the Delta Power Tool Div., Rockwell Tools Inc., and the Deluxe Saw & Tool Co. The following changes

ARCCO
LIQUID GRAVITOMETER
NOW 5 MODELS
Indicating Transmitting Liquid Gravitometer
...for pipelines, gasoline and chemical plants, refineries, etc.
Ruggedly built for hard field use but with laboratory accuracy, the long accepted ARCCO-Anubis Liquid Gravitometer with all its splendid features is now available for recording, controlling, indicating, transmitting, or various combinations of these functions. Write us fully about your application and request Bulletin No. 111 Revised.
1. RECORDING LIQUID.
2. INDICATING TRANSMITTING.
3. INDICATING CONTROLLING.
4. RECORDING TRANSMITTING.
5. RECORDING CONTROLLING.
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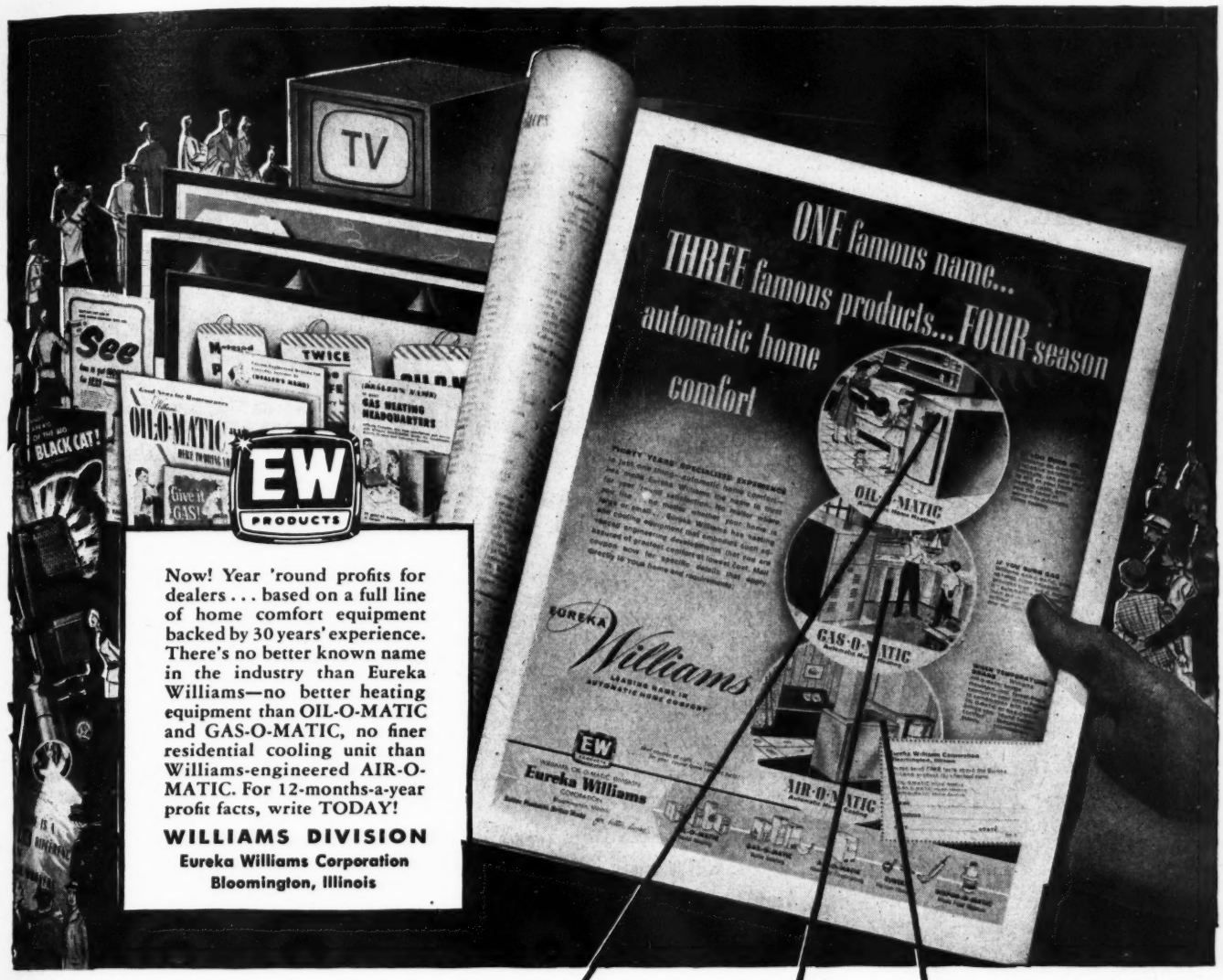
SEND FOR BULLETIN 111 REVISED

An expanded line ...expanded merchandising


TV
See
TWICE
OIL-O-MATIC
BLACK CAT!
EW
PRODUCTS
ONE famous name...
THREE famous products... FOUR-season automatic home comfort
Eureka Williams
GAS-O-MATIC
AIR-O-MATIC
Eureka Williams
Now! Year 'round profits for dealers . . . based on a full line of home comfort equipment backed by 30 years' experience. There's no better known name in the industry than Eureka Williams—no better heating equipment than OIL-O-MATIC and GAS-O-MATIC, no finer residential cooling unit than Williams-engineered AIR-O-MATIC. For 12-months-a-year profit facts, write TODAY!
WILLIAMS DIVISION
Eureka Williams Corporation
Bloomington, Illinois

L. A. Dixon

P. C. Kreuch

C. C. Shenkle

G. T. Bowman

have been made in Rockwell's meter and valve division: PAUL C. KREUCH becomes assistant to the vice president in charge of sales; COURTNEY C. SHENKLE, assistant to the vice president in charge of manufacturing; GILBERT T. BOWMAN, sales manager of both Nordstrom and Gas Products divisions; CARL C. MOORE, central regional manager of sales; and W. S. ANDREWS, manager of the Pittsburgh district.

Succeeding ROYCE D. KING, who is retiring, as manager of the procurement department of Koppers Co. Inc. is P. D. SHOLLAR, who has been assistant manager. Koppers has also announced the appointment of HOWARD J. MEREDITH as division production manager for the company's gas and coke division and the retirement of K. R. HARE, whose duties as manager of the division's Seaboard plant and eastern area representative will be assumed by M. T. HERREID, vice president and general manager of the division.

Koppers has also promoted CARL H. POTTENGER, assistant sales manager, to the position of assistant vice president and chemical division sales manager. And in the engineering and construction division, A. B. FISHER JR. has been named assistant general manager and G. P. WILSON JR. manager of control.

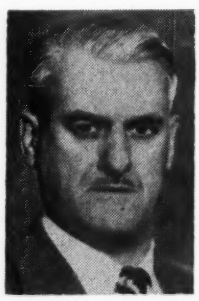
M. L. WAUGH, southeast division manager of Community Public Service Co., was honored recently by the Texas City, Texas, chamber of commerce when he was named outstanding "senior citizen" of the year.

LYLE L. GROFF has been appointed to the post of assistant sales manager of the Norge Heat Div., Borg-Warner Corp., Kalamazoo, Mich., and CHARLES PRICE has been promoted to service parts supervisor.

WALTER A. NAUMER, vice president since 1950, has been named president of the Pyrofax Gas Co., a division of Union Carbide & Carbon Corp., New York.

The following promotions have been announced by Titeflex Inc., Newark: HENRY S. ELDER to executive vice president; GEORGE K. LICHT to vice president in charge of production; and JOHN J. PHILLIPS to vice president in charge of sales and engineering.

Sprague Meter Co., Bridgeport, Conn., has named WILBUR A. ROSS to the post of factory manager and STANLEY J. RAUSON as assistant. Mr. Ross has been plant engineer and Mr. Rauson plant methods and tool engineer.

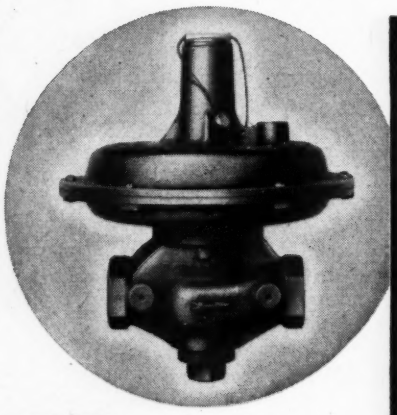


W. A. Ross

S. J. Rauson

Steady

REYNOLDS LOW PRESSURE REGULATORS



PIPE SIZES:
¼" to 8"
¼" to 3" with screw connections
3" to 8" with flange connections

REPRESENTATIVES:

H. D. "Mike" Meuffels
423 Dwight Building
Kansas City, Missouri

Seidenglanz & Co.
2nd Unit, Santa Fe Building
Dallas, Texas

Eastern Appliance Company
281 Vassar Street
Cambridge, Massachusetts

Waldo S. Hull
258 Lee Circle
Bryn Mawr, Pennsylvania

Reynolds Low Pressure Regulators guarantee steady, constant, unvarying outlet pressure even though the volume varies and inlet pressure fluctuates. Precision built and delicately balanced for accurate performance on low pressure installations, the units illustrated are backed by factory tests over a wide range of operating conditions. Reynolds Low Pressure Regulators are economical and safe. Our Engineering Department is at your service.

GAS CONTROL Since 1892

Reynolds Gas Regulator Co.
ANDERSON, INDIANA, U. S. A.

GAS CONTROL SINCE 1892

"SALES CLINCHERS" FOR GAS RANGE SALESMEN

No. 2 of a series

To sell her the *GAS* range, show her the *"COFFEE-WARMER"* feature of the ALLTROL® *Center Simmer*

Wonderful "keep warm" temperature of 130° to 175° —just right for keeping coffee—or food—at its flavorful best . . . deliciously hot, ready to serve! It's exclusive with ranges* featuring the Alltrol Center Simmer surface burner. And it's another reason why your prospects will become your customers.

ONLY ALLTROL BURNERS HAVE A *COMPLETE* HEAT CYCLE

Full flame Starting Burner for quick boil or fast frying.

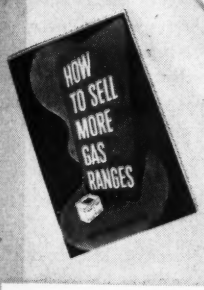
A full range of intermediate heats when wide spread of heat is needed.

Click . . . here's efficient "Center Simmer" that maintains boiling in any covered vessel.

Click . . . a gentle "Keep Warm" heat . . . without further cooking.

**Write for names of ranges featuring ALLTROL Center Simmer.*

® *Trade Mark Reg. U. S. Pat. Office*



SEND FOR FREE BOOKLET,
"How to Sell More Gas Ranges"
Address Dept. 43G

HARPER-WYMAN COMPANY

8562 Vincennes Avenue — Chicago 20, Illinois

"ALLTROL CENTER SIMMER" MAKES GAS THE WINNER!

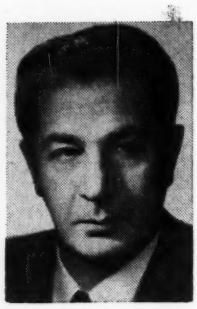
ALLTROL® CENTER SIMMER

J. H. O'BRIEN has been promoted from assistant treasurer to treasurer of the Peoples Water & Gas Co., North Miami, Fla.

M. OCCHI has succeeded P. J. HENNELLY as superintendent of the city street department of Laclede Gas Co., St. Louis. Mr. Hennelly was with Laclede for 51 years.

Crane Co., Chicago, has announced the appointment of V. P. RUMELY as senior vice president, manufacturing, and L. N. BLUGERMAN as vice president. Mr. Blugerman will have charge of production in the company's Chicago and Chattanooga, Tenn. plants, reporting to Mr. Rumely, who will coordinate operations in all of Crane's subsidiaries.

V. P. Rumely



L. N. Blugerman

As a result of the contemplated retirement of RALPH H. TAPSCOTT as chairman of the board of Consolidated Edison Co. of New York, H. R. SEARING, president, has been named chief executive officer of the company. Mr. Searing, with ConEd since 1909, was elected president four years ago after advancing through the company's operating departments. JOHN H. AIKEN has been named vice president in charge of the commercial relations, purchasing and stores, fuel, and property protection departments of ConEd.

With the retirement of BERNARD J. PETTIGREW from the Charleston group of Columbia Gas System Inc., R. K. TALBOTT has been elected to succeed him as secretary. C. E. GOODWIN succeeds Mr. Talbott as assistant secretary.

JONATHAN D. LANKFORD has been named chief of the Bureau of Mines Region V Fuels Technology Div., Minneapolis, succeeding ALEX C. BURR, who has resigned to return to the full-time directorship of the North Dakota Research Foundation. Dr. Burr will continue to serve the bureau as a consultant.

ARTHUR C. RISSBERGER has been promoted from assistant manager to manager of the employee relations department of the Rochester (N. Y.) Gas & Electric Co.

REX REEDER, executive vice president of the Marine National Exchange Bank, Milwaukee, has been elected to the board of directors of Allis-Chalmers Manufacturing Co., Milwaukee.

BERNARD M. SHANLEY has resigned as a member of the board of directors of the Public Service Electric & Gas Co., Newark.

W. PAUL JONES, Servel president, has joined the group of prominent executives who have appeared in national magazines as Lord Calvert's "Men of Distinction."

ERNIE HOLLAND has been appointed director of sales training in the mainland division of the British Columbia Electric Co. Ltd., Vancouver.

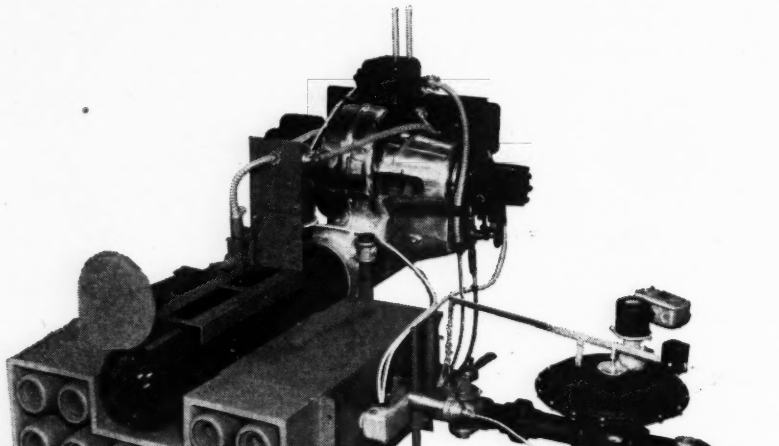
Transfers

Whirlpool Corp., St. Joseph, Mich., has elected as vice president JOHN A. HURLEY who is returning to Whirlpool after eight years with Sears Roebuck & Co. The company has also appointed DAVID J. HERMAN as manager of utility relations and PAUL M. WERTH as regional sales manager.

CLAUDE A. GATES, formerly vice president of Wheelco Instruments Co., has become a representative of the Claud S. Gordon Co., Chicago, in New York City, northern New Jersey, Long Island, Westchester and western Connecticut.

WEBSTER DUONETIC*

for Dual Fuel Firing



The WEBSTER DUONETIC* now offers unsurpassed economy, efficiency and trouble-free operation in the combination oil and gas firing equipment field. Never before have both fuels been burned so well so simply.

You can rely on the usual WEBSTER quality to provide you with the best.

Both burners employ electric ignition, constant electric ignition on the oil burner, and electric ignition for the gas burner safety pilot.

*TRADEMARK

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

MANLEY C. POTTER has been named plant engineer of the Robertshaw Thermostat Div., Youngwood, Pa. He comes to Robertshaw from Westinghouse Electric Corp.

M. C. Potter
Robertshaw

R. E. Erskine
Cribben

The newly created position of special products manager for Cribben & Sexton Co., Chicago, is being filled by ROBERT M. ERSKINE. RICHARD E. ANDERSON has replaced him in Minneapolis as district manager.

L. Z. HERRON is now business promotion manager for the Zanesville district of the Ohio Fuel Gas Co., moving there from the company's Athens district.

RICHARD L. STONE, formerly senior research engineer with the AGA Laboratories in Cleveland, has joined the William Wallace Co., Belmont, Calif., as research engineer.

Deaths

W. REED MORRIS, retired vice president and general manager of the gas and coke division of Koppers Co. Inc., died early in March in Orange, N. J. Although he retired several years ago, Mr. Morris had continued to serve Koppers as a special consultant.

GUY W. FALLER, former executive of the Public Service Co. of Colorado, died recently. He was president and general manager of the company from 1940 until 1943 at which time he became chairman of the board of directors, the position he held at the time of his retirement in 1951.

WILLIS E. HUGHES, manager of employee relations for Rochester Gas & Electric Co., died recently. His first position with the company was that of safety engineer.

FRED C. ARMBRUSTER, 63, gas operations manager for Central Illinois Public Service, died recently. His 40-year career in the industry varied from a position as a timekeeper to that of vice president and general manager.

WILLIAM A. DEVINE, who was for more than 30 years southern New England sales representative for the Kompack Water Heater Co. and the United American Bosch Corp., died recently after a long illness.

Millions of users agree—
you cut more pipe with less work with RIDGID Heavy-Duty Cutters

There's a big difference in pipe cutters—and you're sure of it the first time you slap a RIDGID on a pipe (any kind) and see how easily cleanly it rolls through the metal. Beautifully balanced for easy action. Factory tested for perfect tracking—and guaranteed warp-proof housings of special malleable hold it. High alloy thin-blade or heavy-duty cutter wheels that leave practically no burr. You cut pipe fast with least effort. Ask your Supply House for the more-for-your-money RIDGID.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

NEWS

San Diego Gas employees asked "How are we doing?"

All employees of the San Diego (Calif.) Gas & Electric Co. recently were asked "How are we doing?" by the company, although it took more than one question and answer to find out. The question came in the form of an employee opinion survey, conducted for the company by the industrial relations section of the California Institute of Technology, that queried employees on matters relating to the operation of the company.

One week was required to get all employees in on the survey. A total of 42 meetings were held, each meeting attended by a company representative and a representative from Cal Tech, who actually conducted the survey and took possession of the questionnaires when they were completed. The survey was conducted during working hours, necessitating the 42 meetings. The survey teams—two of them—traveled from meeting place to meeting place, bringing the survey to as many as 236 employees in the largest of the meetings and to as few as three in the smallest.

The questionnaires are now being tabulated by Cal Tech's industrial relations section (no one except Cal Tech men will ever see any of the completed questionnaires). When completed, the tabulated results will be printed and copies mailed to all employees.

Ward Heater Co. bought by Kresky Manufacturing Co.

Kresky Manufacturing Co., Petaluma, Calif., has purchased Ward Heater Co., Los Angeles, formerly operated by the Estate Heatrola Div.

In making the announcement, C. A. Miller, president of Kresky, said that Ward will operate independently and that the pattern of distribution for both firms will not be changed. Plans are now being formulated for expansion of distribution and sales for both firms.

Continuing as officers of Ward Heater are Russell Jarrett, vice president and general manager; William H. Hoffman, general sales manager; and James J. Sherlock, treasurer.

Dealers and utility men go to Evansville for show

Servel's Show of Stars was put on in February at its home base in Evansville, Ind. before more than 400 home appliance dealers and utility representatives who had traveled from mid-Tennessee and southern Kentucky by a specially chartered 11-car train. This performance was just a portion of the nation-wide tour which started in New York on January 21.

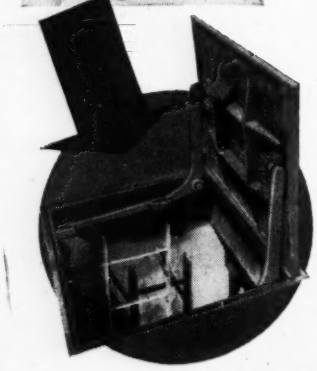
The Evansville show was attended by the largest audience the show had anywhere during its road tour with additional appliance retailers from Indiana and Illinois present, together with many Servel employees and their families.

One of its other recent performances was

Participating in the official untying of the bow during the introduction of the Ice-Maker at the home show are (l. to r.): Charles M. Sturkey, Seattle Gas; Bea Donovan, star of the company's television show; and Prudence Penny, home economist of the Seattle Post-Intelligencer.

WACHS Safety Vault Covers

for Valve, Meter, Transformer and District Governor Vaults



Features

- One man can quickly raise cover with ease and without danger.
- Cover can not drop into vault or slam to cause injury or damage.
- Cover can be opened from the inside of the vault by one man—an added safety feature.
- Positive tamper proof lock that cannot be opened unless key is used.
- Open cover stands in upright position indicating that manhole is open.
- Unobstructed 30" square opening gives ample room for installation and servicing heavy equipment.
- Heavy duty for heavy traffic—cast iron frame and ribbed steel cover both machined for accurate fit to eliminate rattle.
- Moisture resistant, heavy cast steel levers and linkage with stainless steel pins in "Oilite" permanent oiled bronze bushings for long trouble-free service.
- Complete counterbalance structure protrudes less than 6" from the wall.

WACHS NATIONAL PIPE SAWS

Make Fast and Accurate Cuts on 10" to 48" Cast Iron and Steel Mains

16" clearance between 24" mains

Features

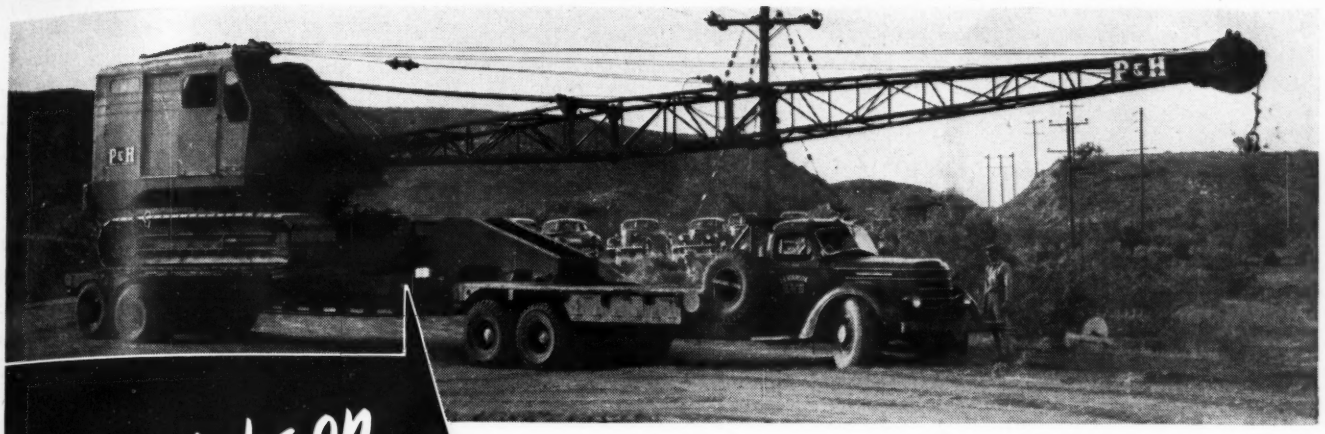
- Minimum Pipe Line down time.
- Cuts under water in flooded ditches.
- No broken pipe, milled cut.
- Thor Air-Powered, no flames near pipe.
- Set-up time about 15 minutes.
- Portable — weighs only 315 lbs. Two men can carry and set up unit.
- Small excavation—only 16" clearance needed.
- One machine cuts all pipe sizes from 10" to 48".
- Only two adjustments necessary for size changes.
- Cuts 24" pipe in 24 minutes — 36" pipe in 36 minutes, etc.

Write today for descriptive folder and engineering data on this new labor saving saw.

THE E. H. WACHS COMPANY

Manufacturers of Engines, Valves and Machinery since 1883

1525 NORTH DAYTON STREET · CHICAGO 22, ILLINOIS



Keep jobs on Schedule with TULSA* WINCH...

To get equipment where it's needed, when it's needed, safely and efficiently, is no longer a major problem with contractors . . . they rely on Tulsa Winch to do the job. Whether you're moving power shovels or light timbers, there is a Tulsa Winch for every make and model of truck and crawler tractor in capacities from 6,500 to 80,000 lbs.

Tulsa* Winch
TULSA, OKLAHOMA
DIVISION OF VICKERS Inc.

*Reg. U. S. Pat. Off.

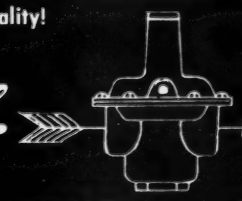
NOW WE'RE IN THE *Millions!*

1,000,000th MAXITROL ROLLS OFF THE LINE IN 3½ YEARS

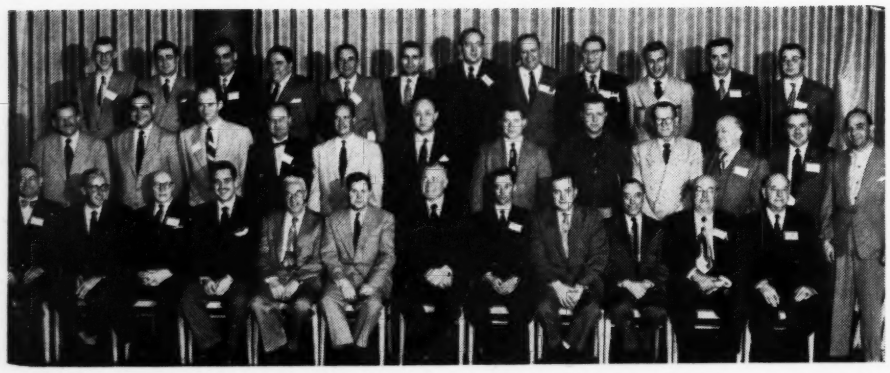
We'll take a bow! Proof to us that the now-famous "Straight-Thru-Flow" of gas principle is a boon to the industry is our 1,000,000th MAXITROL Gas Pressure Regulator produced in January, 1953, three-and-one-half years after introduction of the new design!

We'll also give a heart-felt "accolade" to an industry that, so readily, accepted the first major change in gas pressure regulators in over 50 years!

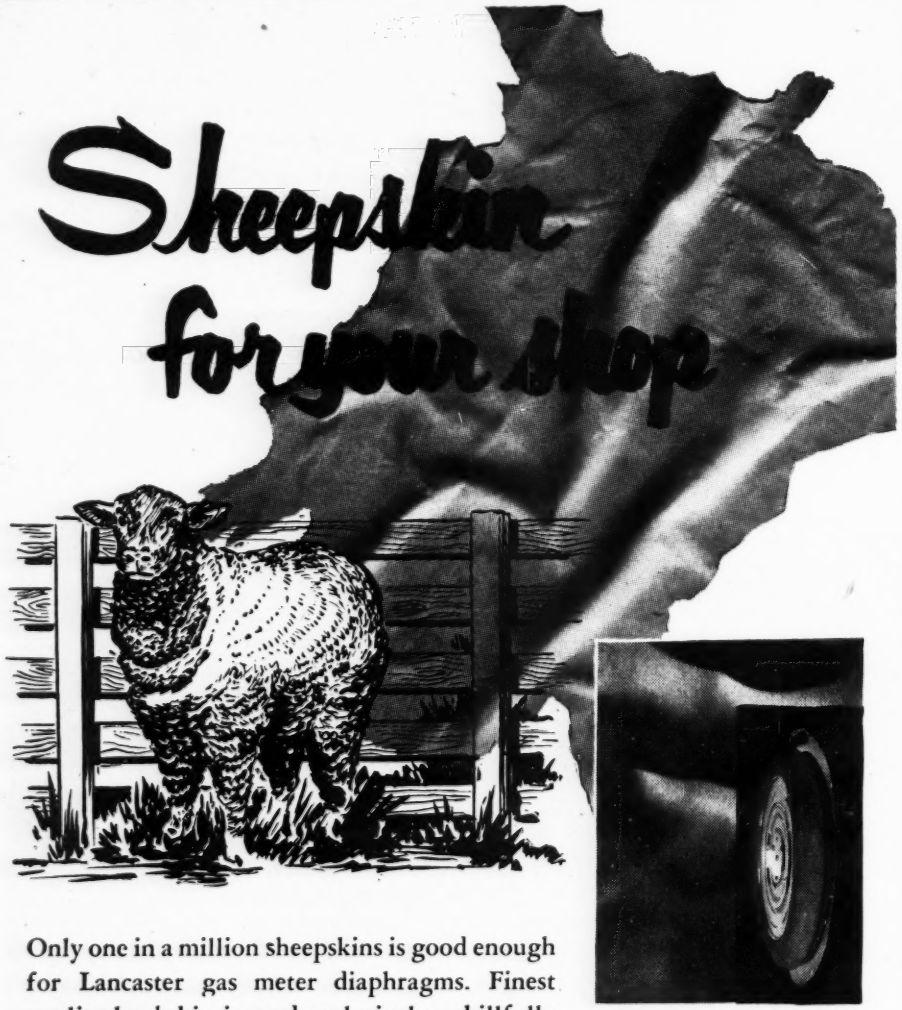
MAXITROL Gas Pressure Regulators will be copied in the coming years. We accept the compliment, and the similar compliments bound to come as MAXITROL continues ahead; continues its leadership in imaginative thinking and originality!

Maxitrol  *IS BEST BY FAR!*

DETROIT REGULATOR COMPANY
1742 RIVARD STREET — DETROIT 7, MICHIGAN
Sold on the Pacific Coast by: PACIFIC SCIENTIFIC CO., San Francisco, Los Angeles, Seattle, Portland



Empire Stove Co.'s branch managers, engineers, and home office sales personnel attended Empire's sales convention recently in Belleville, Ill., where a new line of heating equipment was introduced (see New Products department).



Only one in a million sheepskins is good enough for Lancaster gas meter diaphragms. Finest quality lambskin is used exclusively—skillfully tanned by the expensive chrome process. Uniformly soft and pliable, the leather in Lancaster diaphragms will hold its shape and flex millions of times without breaking. No wonder Lancaster Metal Rim Diaphragms stay in the meter for so many years.

Skins from small, young New Zealand sheep best meet our needs. After chrome tanning, the fine fibers between inner and outer layer of the leather are still springy and "alive".

METER PARTS CO.

in the Seattle, Wash. area, where the show coincided with the introduction of Servel's automatic Ice-Maker refrigerator by the Seattle Gas Co. at the 19th annual Seattle Home Show.

Tulsa plans to house more than 20,000 during IPE

Tulsa, Okla., through the International Petroleum Exposition housing bureau, is planning to house an estimated 22,000 to 25,000 oilmen and exhibitors May 14-23 during the exposition and, contrary to rumors of inadequate housing, there is every assurance from the housing bureau that sufficient preparations have been made to accommodate all comers.

Exhibit space contracts issued total 852 for prime exhibitors and, counting associate exhibitors, more than 1500 oil industry manufacturers, suppliers, and service companies will participate in the exposition. More than 30 acres will be occupied by the 30th anniversary affair of the IPE. Attendance at the big show is expected to reach 500,000, according to William B. Way, general manager.

First industry-wide range campaign gets underway

Getting under way this month is Operation Sales, the first industry-wide sales program embracing the entire membership of the domestic gas range division of the Gas Appliance Manufacturers Assn. It is made up of a completely packaged promotion of practical point-of-sales aids designed to help dealers sell more automatic gas ranges.

With the appearance of two-color ads in leading trade magazines during April, the promotion intends to bring sales training right into the dealer's store, according to W. T. Trueblood Jr., Magic Chef Inc., chairman of the special committee working on Operation Sales, with a series of short, snappy demonstrations that can be learned by salesmen in a matter of minutes.

The first ad, headlined "The 45-second tea kettle speed test sells more gas ranges," shows the dealer how he can perform this instant heat-on, heat-off test and get the customer to take part in it. Following ads will tell of additional on-the-spot demonstrations that highlight other range features.

The new promotion points up a continuing attempt on the part of the manufacturer and distributor to be of greater assistance to the dealer in selling the manufacturer's product. It is not designed to replace the "CP" program but is another forward step in the gas industry's determination to join forces in modern merchandising to match gas range production and efficiency, Mr. Trueblood pointed out.

In addition to the trade publication ads special demonstration books will be made available to dealers through GAMA, distributors, manufacturers, and utilities. News-

paper mats, in addition to direct mail pieces and envelope stuffers, will be furnished for gas company and dealer use.

Operation Sales is just one segment of the first coordinated campaign by the gas range industry that ties in with all gas promotions by individual companies as well as trade associations. For example, GAMA is following through by promoting the establishment of gas appliance sales training courses in leading universities and colleges, and AGA will kick off this month its "Carnival of Gas Cooking" complementing the Operation Sales ads.

Through mailings made by utilities and GAMA, 85% of those selling gas ranges will be contacted. In this manner, the committee hopes to encourage the further use of the demonstrations by having manufacturers follow them up with their own distributors and dealers. It also hopes this will increase cooperation between dealers and utilities such as typified by the Philadelphia Gas Works and other gas utilities which have assisted in running lines into dealers' showrooms so that working models of gas ranges are available for demonstration to customers.

"The whole idea of this 'selling by doing' campaign," Mr. Trueblood said, "is to bridge the most important three feet in sales—the distance between the customer and the dealer . . ."

Vent marking rule adopted by requirements committee

Under a recent ruling adopted by the executive committee of the AGA approval requirements committee, a prominent marking showing the type of vents to be used with vented recessed gas heaters must appear on all such heaters.

The new marking is a guide to the installer and regulatory authorities as to the type of vent (fluepipe) system that must be used with approved vented recessed heaters. Information on the type of vents to be used is also required to be included in the instructions supplied with each heater.

The marking is required to appear on the heater in a conspicuous position where it can be observed during the rough-in inspection. If the manufacturer does not furnish the vent system with the heater, the unit must be marked for the type of "B" vent, or wall vent, or equivalent vent listed by a nationally recognized testing agency for recessed heaters.

Management awards won by five gas companies

Certificates of management excellence for 1952 have been awarded five gas companies by the American Institute of Management.

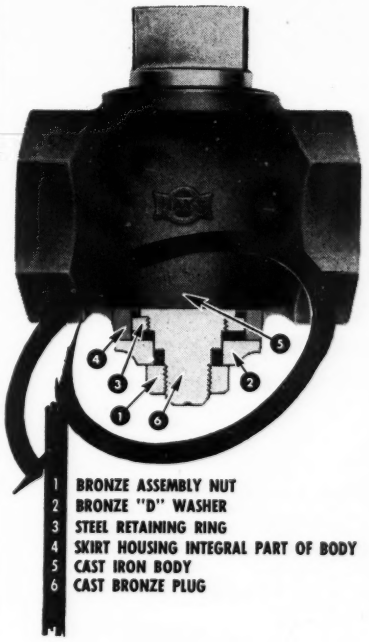
The winners are El Paso (Texas) Natural Gas Co.; Lone Star Gas Co., Dallas; Oklahoma Natural Gas Co., Tulsa; Pacific Lighting Corp., San Francisco; and Washington (D. C.) Gas Light Co., which received the

More and More are in service...

HAYS®

TAMPER-PROOF GAS STOPS

BECAUSE OF THESE FEATURES


1 BRONZE ASSEMBLY NUT
2 BRONZE "D" WASHER
3 STEEL RETAINING RING
4 SKIRT HOUSING INTEGRAL PART OF BODY
5 CAST IRON BODY
6 CAST BRONZE PLUG

- Tamper-Proof Design with Non-Removable Plug.
- Extra Grade Gray Iron Body, Gas Service Bronze Plug.
- Steel Retaining Ring Prevents Removal of Plug.
- Steel Retaining Ring Assembled to Bottom of Plug—Eliminates Possible Damage to Precision Ground Surface of Plug and Body.
- Steel Retaining Ring Threaded and Staked to the Largest Metal Diameter on Bottom of Tapered Plug—Assures Retention without Distortion.
- Steel Retaining Ring Anchored without Drill Hole or Pin—Eliminates Possible Shearing of Plug.
- Steel Retaining Ring Recessed and Inaccessible within Iron Body—Gripless and Shearless.
- Plug and Body Precision Ground and Matched for Perfect Seating.
- Individually Tested Under Rigidly Controlled Inspection.
- Lubricated with a Compound of Greases Suitable for Use with Manufactured, Natural or Liquid Petroleum Gases.
- Obtainable in a Variety of Patterns.

AVAILABLE IN

Black or Galvanized

Flat Head Less Check
Flat Head With Check
Flat Head With Lock-Wing

Sizes; ¾"—1"—1¼"—1½"—2"

Write for Folder 120-C D

Also HAYS STANDARD

HEAVY PATTERN IRON BODY GAS STOP

For Over 80 Years the Gas Industry has relied on HAYS Iron Body Gas Stops

HAYS GAS SERVICE PRODUCTS
HAYS MANUFACTURING CO., ERIE, PA.

award for the second consecutive time. Pacific Lighting's award was its third consecutive.

The institute, devoted to improvement of corporate policies and practices, reports that only 330 companies in the U. S. and Canada, out of the 3000 leading concerns whose methods were studied, were found eligible to receive the designation.

New England companies planning consolidations

While celebrating its centennial, Gloucester (Mass.) Gas Light Co. has become involved in a merger and consolidation program of the New England Electric System.

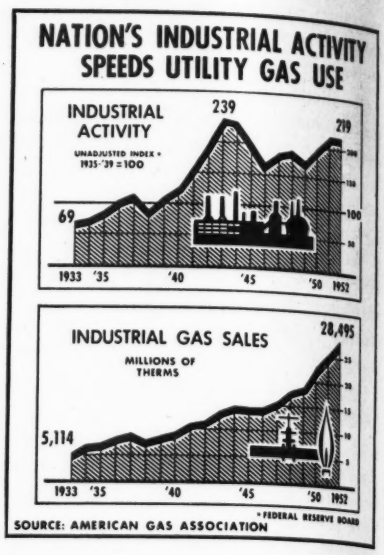
Directors of "North Shore" subsidiaries have authorized the consolidation of the Salem and Gloucester electric companies and the electric operation of Beverly Gas & Electric Co. into a single electric company to be known as Essex County Electric Co. The consolidation of the Salem and Gloucester gas companies and the properties of Beverly Gas into a single gas company to be known as North Shore Gas Co. was authorized at the same time.

Other proposed mergers of electric and gas companies in the Mystic Valley area were authorized by directors of the Malden Electric Co., Suburban Electric Co., Arlington Gas Light Co., and the Malden & Melrose Gas Light Co.

With this move, Malden Electric and the electric operation of Suburban will be merged and called the Suburban Electric Co. Authorization was also received for the merger of Malden & Melrose Gas, Arlington Gas, and the gas properties of Suburban Gas into a single gas company, the Mystic Valley Gas Co.

These consolidations and mergers have also been approved by stockholders and are now awaiting approval from regulatory commissions.

In another move, the New England Electric System, Northern Berkshire Gas Co., and Berkshire Gas Co., all of Boston, applied to the Securities & Exchange Commission for an order authorizing Northern Berkshire to sell its gas properties and business to Berkshire Gas. As a result of the sale, Northern would be solely an electric company while Berkshire would be a gas company.



The upward trend of utility gas use as influenced by the nation's increased industrial output and its defense production is depicted in this graph prepared by the public information bureau of the AGA.

Revenues for 1952 show 10.4% rise over 1951

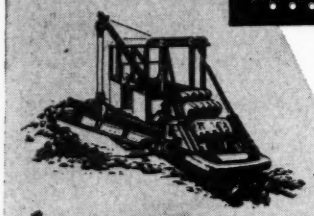
Fourth quarter revenues from sales of gas in 1952 were $668 million, a 14.8% gain over revenues of $582 million in the comparable quarter of 1951, AGA reports. For the 12 months ended Dec. 31, 1952, revenues from sales to consumers total $243 million, a 10.4% rise over the previous 12 month period. Industrial gas revenues were up 14.9% and residential revenues gained 8.4% during the period.

Total revenues of gas utility and pipeline companies, including revenues from sales for resale, during the 12-month period amounted to $3410 million. After deductions for operating expenses, taxes, depreciation, re-

It takes a FULL team

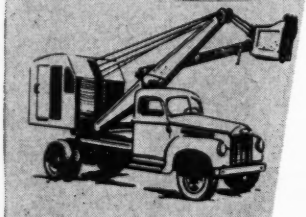
. . . whether it's baseball

. . . or digging equipment



1. This is for big jobs

2. This is for medium jobs



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On many excavating jobs the use of big equipment is costly and time-consuming. The Sherman Power Digger is designed so that you get all the advantages of power digging on these jobs. Thousands of users have proved that the Sherman Power Digger reduces costs. Write today for descriptive literature J7.

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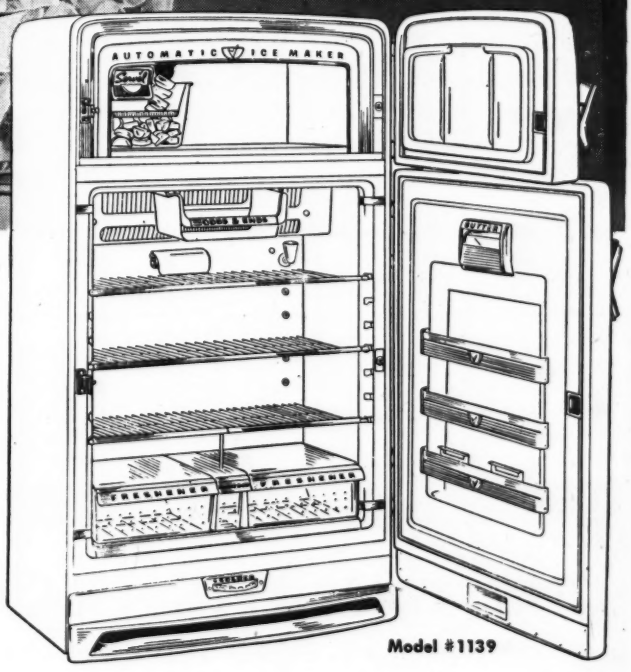
WORLD'S ONLY REFRIGERATOR THAT—

Makes Ice Cubes Without Trays!

AND PUTS 'EM IN A BASKET

Automatically!



Model #1139

GAS utilities across the nation tell us, "Servel's revolutionary Ice-Maker Refrigerator is a sensational opportunity to insure . . . and increase . . . year 'round, night-and-day, kitchen loads"! Thousands of radio-TV spots, scores of 4-color national magazine ads, factory-paid newspaper ads in 109 key cities, billboards, coast-to-coast are telling millions the fascinating Servel "Ice-Maker" story . . . and Servel means gas to millions! Meet this load-boosting opportunity with all 9 Servel Silent Gas Models spotlighted in your showrooms! Brighten your windows and showrooms with colorful Servel displays! Spirit your salesmen with the dynamic Servel story! Call your Servel distributor today!

ONLY SERVEL HAS ALL THESE FEATURES!

- **Silent, no-moving-part operation!**
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- **Big Freezer Compartment!**
- **All the Most Wanted Features plus the Sensational Servel Automatic Ice-Maker!**

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The name to watch for great advances in REFRIGERATION and AIR CONDITIONING

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We'll see you at the AGA Distribution Conference in Chicago April 12

WET TRENCH NO TROUBLE WITH

McWANE-PACIFIC BOLTITE MECHANICAL JOINT CAST IRON PIPE

An incidental but important advantage of Boltite Mechanical Joint is the elimination of joint-making troubles in wet trenches. There is no danger of hot lead "exploding" due to creation of steam. The Boltite joint consists simply of a thick, triangular-shaped, composition rubber gasket, compressed by a movable gland when the bolts are tightened. There is no hazard in assembling this joint in a wet trench. In fact, it can be done under water.

Boltite Mechanical Joints are bottle-tight, flexible, permit pipe-line expansion or contraction. Perfect joints are easily and quickly made by one inexperienced workman. The only tool needed is a ratchet wrench. Write or telephone for complete information.

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Pipe Sizes 2" thru 24"

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Los Angeles 48, Cal.....6399 Wilshire Blvd.
San Francisco 4, Cal.....235 Montgomery St.
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tirement and amortization, net revenues amounted to $470 million. Net income for the period was $340 million while total taxes paid amounted to $500 million.

New all-time peak reached by utility sales in January

Utility gas sales to ultimate consumers in January reached an all-time peak of 5882 million therms, up 4.2% over the 5645 million sold during January 1952, the previous high for a single month, according to the AGA. The association's January index of total gas sales, 174.7% of the 1947-1949 average, is based on a new index, developed to relate current statistics to the comparable data in a post-war group of years.

For the 12 months ended Jan. 31, 1953, utility gas sales were 52,897 million therms, a new 12-month record.

News Notes

Harrisburg (Pa.) Gas Division and Lehigh Valley Gas Division, Allentown, Pa., are changing over to 800 Btu, 0.60 specific gravity gas. Harrisburg requests that appliances shipped into its territory up until June 15 be equipped with burner and orifices for 520 Btu, 0.48 specific gravity and that orifices for the new fuel be attached. After June 15, all appliances should be equipped with burners and orifices for 800 Btu, 0.60 specific gravity. Lehigh Valley's dates: until July 13 orifices and burners for both type gases; after July 13 burners and orifices for the new fuel only.

Company-sponsored events in Vandergrift, Pa., marked the recent opening of a completely remodeled office and shop for the Peoples Natural Gas Co. in the Vandergrift-Apollo-Leechburg area. A luncheon for civic leaders and appliance dealers, an open house, and an employee dinner marked the event. Remodeling included the addition of a meter shop, warehouse and garage space, and enlargement of customer service facilities.

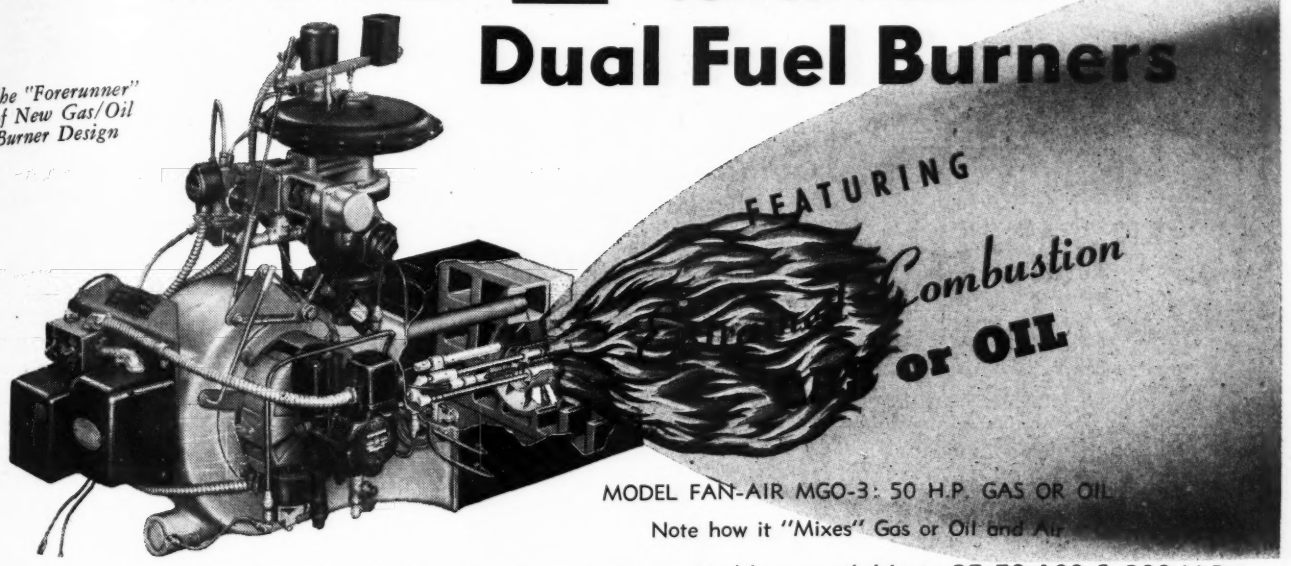
A group of 15 local dealers in L. P. gas and appliances have formed the Gas Institute of Greater Jacksonville (Fla.) with W. Harold Duguid, vice president and general manager of the Jacksonville Gas Corp., as president. Primary aim of the group is to promote the sale and use of LPG and its appliances as well as to compile and disseminate pertinent information relating to the industry locally.

Philco Corp. has announced that the manufacturing and distribution operations of Philco Corp. of Canada Ltd., Toronto, have been integrated with Philco International Corp. Philco International, headed by President Sydney L. Capell, has distribution centers in more than 100 countries and manufacturing or assembly plants in six countries.

AN ENTIRELY ***NEW*** CONCEPTION IN

Dual Fuel Burners

The "Forerunner" of New Gas/Oil Burner Design



MODEL FAN-AIR MGO-3: 50 H.P. GAS OR OIL
Note how it "Mixes" Gas or Oil and Air

Proudly picturing the FAN-AIR MGO Series of COMBINATION AUTOMATIC GAS AND OIL BURNERS. Not a "copy" nor a compromise. Obviously METTLER LEADERSHIP is again demonstrated with this design representing the first major advance in "packaged" Dual Fuel Burners. Nothing else like it.

- Now available in 25-50-100 & 200 H.P. sizes. For **ANY** Gas & Fuel Oil No. 2 to No. 5.
- A simple **"FLIP OF THE SWITCH"** changes from GAS to OIL or in reverse.
- Built to **MEET** Approval Requirements.
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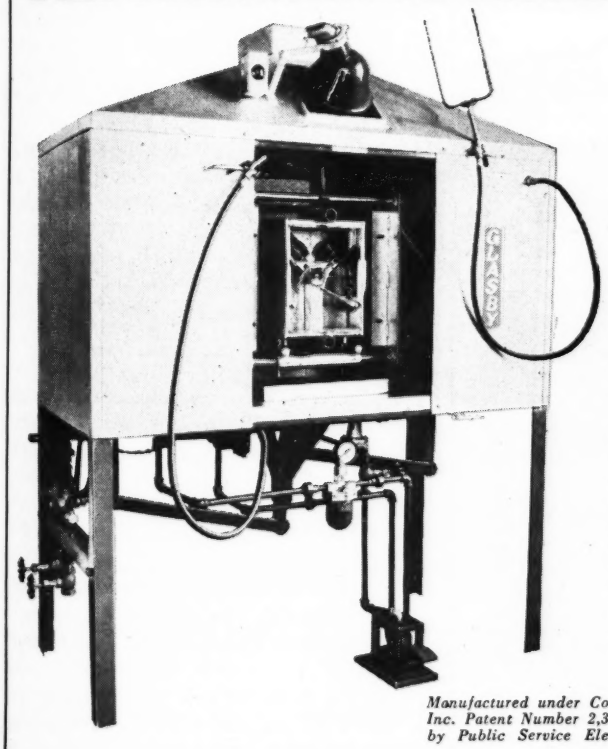
Fast Production on Precision Meter Repairs



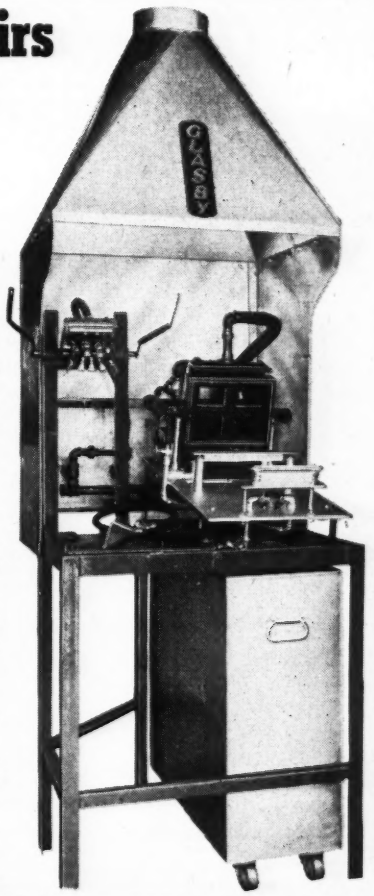
Minimum Repair Time Means Maximum Dollar Savings

← Meter Front and Back Removing Machine

This machine removes the front and back from gas meters in a fraction of the time previously required thus facilitating repair of diaphragms. Two models available — 5 light meter and 10 light meter capacity. Both models are adjustable to most makes of meters and feature additional safety devices to protect the operator.

Meter Top and Valve Box Cover Removing Machine →

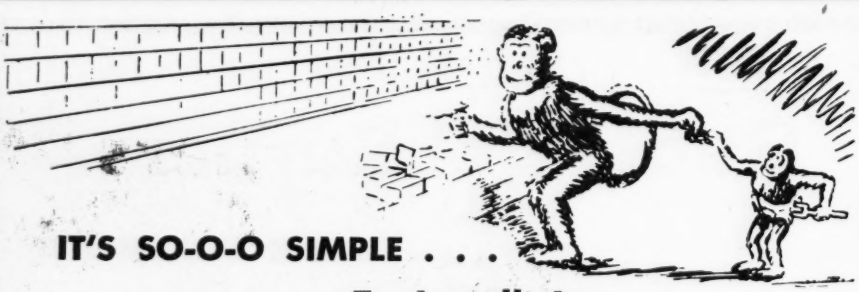
This machine facilitates the removal of meter tops and valve box covers to minimize the time-consuming problems of meter repair operation. Available in 5 light meter and 10 light meter sizes, both adjustable to most makes of meters. Both models feature devices for the safety of the operator.



Manufactured under Consolidated Edison Company of New York, Inc. Patent Number 2,342,045. Application development assistance by Public Service Electric and Gas Company of New Jersey.

THE J. P. GLASBY MFG. CO. INC.

BELLEVILLE 9, NEW JERSEY — *Manufacturers of Glasby Conversion Burners and Furnaces*



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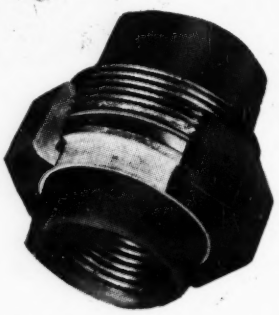

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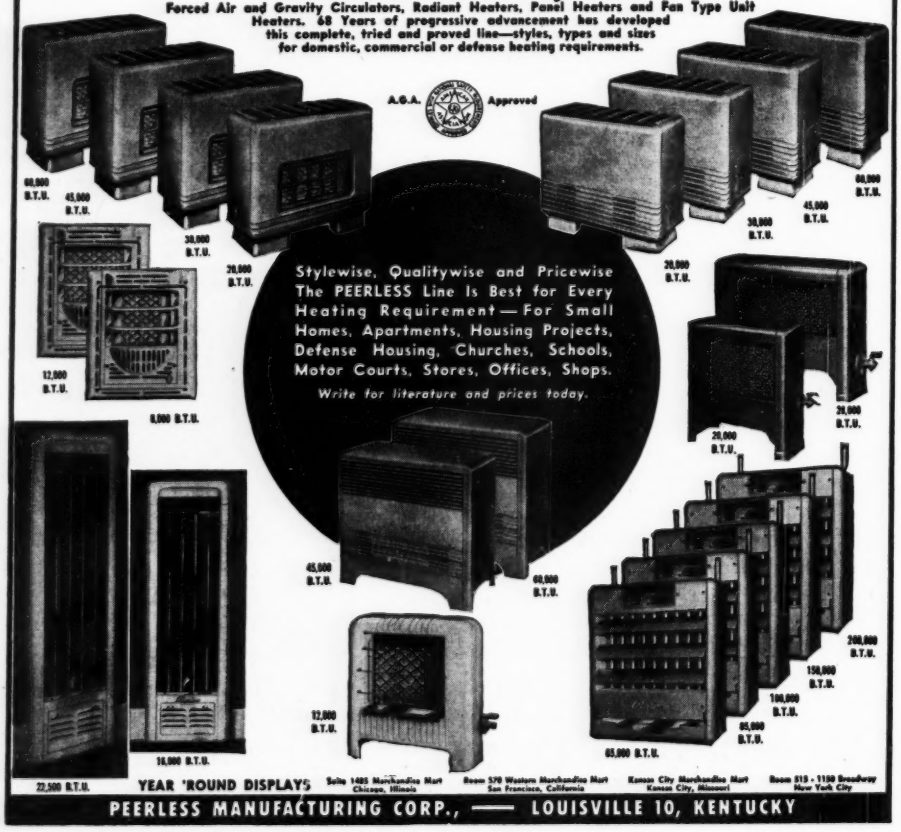
Forced Air and Gravity Circulators, Radiant Heaters, Panel Heaters and Fan Type Unit Heaters. 68 Years of progressive advancement has developed this complete, tried and proved line—styles, types and sizes for domestic, commercial or defense heating requirements.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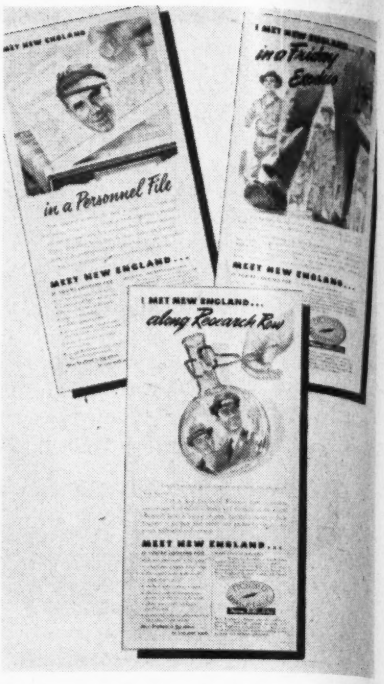

I MET NEW ENGLAND... in a Personnel File
I MET NEW ENGLAND... in a Friendly Exchange
I MET NEW ENGLAND... along Research Row
I MET NEW ENGLAND...

This series of ads won highest honors for New England Electric System from the Advertising Federation of America. The award was based on the series of ads titled "I Met New England," featuring the area's resources and appearing in national publications.

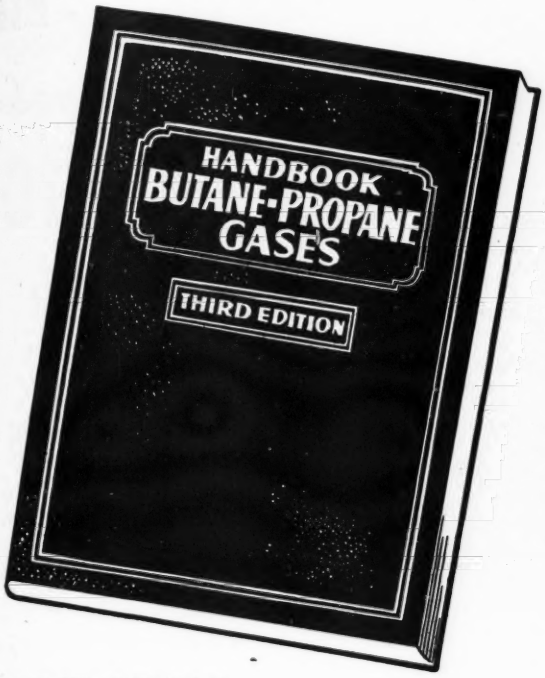
American Car & Foundry Co., New York, has received an order from Warren Petroleum Corp. for 500 tanks cars—250 11,000-gal. dual service high pressure cars to carry L. P. gas and 250 of 8000-gal. capacity to carry gasoline. Added to a 1952 order for 400 tank cars, this brings to 2500 the number ACF has delivered to Warren since the end of World War II.

On March 1, the A. O. Smith Corp., Milwaukee, opened a new service branch of its production service division at Oakland, Calif., to provide a central West Coast location for handling of replacements parts, service and repair, and training operations. George A. Carlson is manager of the new branch.

Designed to exhibit Servel's residential, commercial, and industrial air conditioning equipment to both dealers and the public, the first New York metropolitan area showroom has been opened by Servel's wholesale distributor, Air Equipment Distributors Inc.

Quite a milestone was reached recently when Houston (Texas) Natural Gas System installed the 100,000th meter in the Houston district. Just a little more than five years ago (in December 1947) the company celebrated the installation of its 100,000th meter in its entire system. The Houston district has almost doubled since that time and at the end of 1952 there were 179,265 meters operating in the system.

The Only Complete Reference Book on Liquefied Gas Engineering, Installation and Operation



352 PAGES of Technical Facts, Charts, Diagrams, Photographs, including Latest Processes and Materials

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Bottled Gas Systems
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Multiple Utility Service from a Central Plant
Comparative Performance with Other Fuels
Appliance Installation and Testing
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Enrichment, Peak Load and Standby Uses
Fuel for Internal Combustion Engines
N.B.F.U. Pamphlet No. 58 (1947)
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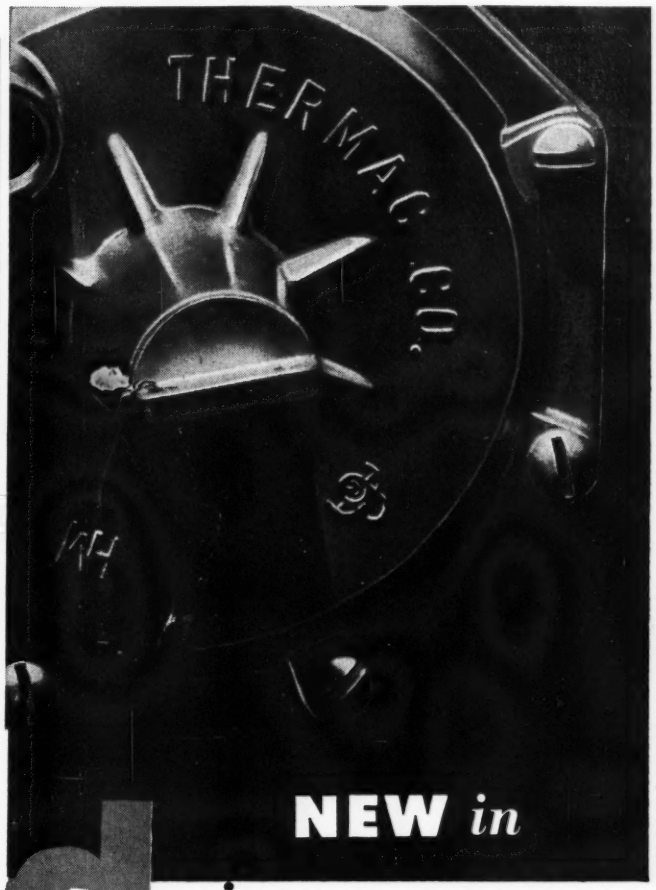

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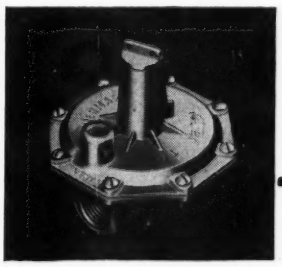
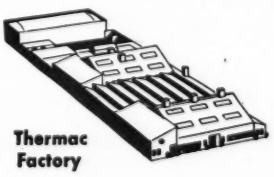
Leadership in the industry demands that we constantly improve both our product and service. The new Thermac 8-sided Appliance Regulator achieves relatively larger effective diaphragm area with resultant higher capacities with relation to its outside dimensions. Greater sealing against diaphragm leakage, easier to install in tight spots, plus provision for vise grip are new special features.

Here in the new "T" Series you have a smaller regulator with more capacity at a lower price and of the highest quality obtainable. Send for our new catalog giving complete data.



Thermac "T" Series Appliance Regulator



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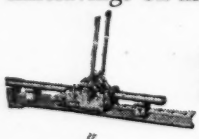
Installing pipe underground is quick and simple this way. With a GREENLEE Hydraulic Pipe Pusher *one man* pushes pipe through the ground—under streets, railways, walks, lawns, floors. Saves time, cuts costs through elimination of extensive ditching as just a short trench accommodates the Pusher. No tearing up of pavement, lawns, floors . . . eliminates tunneling, back-filling, tamping, repaving. Cuts job time to a fraction. Pusher often pays for itself through timesavings on first job or two.



No. 790 GREENLEE PUSHER For 3/4 to 4-inch pipe. Six speeds—5,600 to 40,000 lbs. pushing pressure.

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TOOLS FOR CRAFTSMEN

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Get facts on timesaving Greenlee tools now. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1944 Columbia Avenue, Rockford, Illinois, U. S. A.

Associations

Distribution conference gets under way April 13

H. B. Andersen

Nearly 1200 gasmen will meet at the Sherman hotel in Chicago on April 13-16 to attend the 29th annual distribution, motor vehicle, and corrosion conference sponsored by the operating section of the American Gas Assn.

The four-day conference will get underway Monday morning, April 13, with welcoming addresses by James F. Oates, Peoples Gas Light & Coke Co., Chicago, and H. Carl Wolf, AGA managing director. Following these addresses, delegates will hear progress reports on the various research projects being carried out under PAR presented by T. L. Robey, AGA coordinator of research.

The first general session will continue with reports from the operating section's special committee on safety by Chairman H. Bruce Andersen, Philadelphia (Pa.) Gas Works and from the committee on specifications for operation and maintenance of a gas distribution system presented by Chairman F. H. Bunnell, Consumers Power Co., Jackson, Mich.

As a further step toward safe operation, special AGA committees have been working with the ASA on revising existing codes on pressure piping, and Frank S. G. Williams, chairman of the ASA sectional committee, will give this committee's report. The progress of subcommittee 8 of the ASA sectional committee (distribution) will be reported on by Chairman F. G. Sandstrom, Consolidated Edison Co., New York.

Metering, design of odorization equipment, customer service policies, X-ray control of pipeline welding, and corrosion will be featured at the Tuesday morning general session. Subjects ranging from decentralization of garages to safety and safe practices for motor vehicle operators will be presented at Tuesday morning meetings sponsored by the motor vehicles committee.

The Wednesday morning general session will feature the American Telephone & Telegraph Co.'s demonstration of hazards in underground manholes. Fleet management and cathodic protection for distribution systems will also be on the program.

Gas distribution systems will be the major topic under discussion at the Thursday session, with talks on handling of gas meters, dust control, and replacement of mains and services. Luncheon discussions will cover the following topics: customer service, construction and maintenance, corrosion, meters and metering, and motor vehicles.

The program has been arranged by com-

Johnsonite PLASTIC PIPE will eliminate CORROSION entirely

JOHNSONITE No. 4 is highly recommended for gas lines.

GUARANTEED to last over 30 years even in the most corrosive soil conditions.

Lightweight and easy to handle.

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A Complete Line of Fittings In All of the Standard Sizes.

Gen. Pipe Size	Approx. Wgt. Per Ft.	Nominal O.D.	Cal. Burst P.S.I.
½"	.05 lb.	.60	830 lb.
¾"	.075 lb.	.855	600 lb.
1"	.135 lb.	1.14	600 lb.
1¼"	.20 lb.	1.42	600 lb.
1½"	.32 lb.	1.73	660 lb.
2"	.45 lb.	2.25	550 lb.
3"	.65 lb.	3.25	380 lb.
4"	1.00 lb.	4.10	360 lb.
6"	2.33 lb.	6.22	340 lb.

Write for Complete Catalog and Name of Nearest Dealer

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DEPT. 55-C

mittees working with John M. McCaleb, Columbia Gas System Service Corp., Columbus, Ohio, chairman of the AGA distribution committee.

Accountants will discuss tax problems at conference

Topics ranging from tax problems to customer relations have been arranged for the National Conference of Gas & Electric Utility Accountants when they gather for their three-day meeting at the Sherman hotel in Chicago on April 20-22.

Recent regulatory trends will be reviewed by Spencer C. Eddy, New York State Public Service Commission; Kenneth Haagensen, Allis-Chalmers Manufacturing Co., Milwaukee, will discuss the human side of business. He will be followed by Harold Quinton, Southern California Edison Co., Los Angeles, who will speak on the effect of rising costs on our economy.

In a feature sponsored by the accounting employee relations committee, George Callens, Detroit Edison Co., will report on the selection and training of personnel and H. F. Noneman will discuss pension plans. A talk on book and taxable net income by a representative of the department of internal revenue will highlight a joint meeting for general and tax accountants.

Regulatory commission theories on rate of returns, budgeting and forecasting, methods and cost control, plant accounting, depreciation, work standards, and meter reading are also other problems slated for discussion, as are customer accounting and customer relations. Responsibility accounting and internal auditing will be featured at the group meeting of the AGA-EEI internal auditing committee.

More than 2500 sq ft of exhibit space at the Sherman will be devoted to displays of the newest office machines and equipment now available.

Essay contest winners headed by H. R. Zeamer

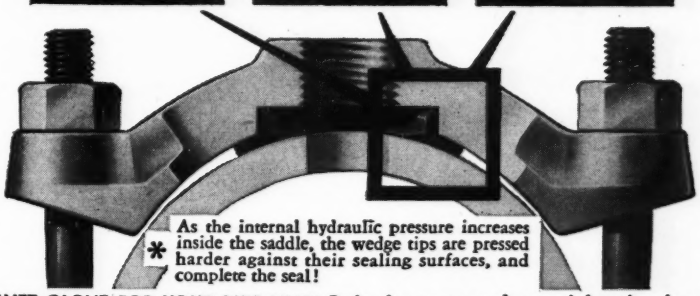
Winners in the exposition essay contest sponsored by the AGA and GAMA in conjunction with the 1952 AGA convention have been announced. H. R. Zeamer, sales promotion manager of the Philadelphia Gas Works Division, received first prize, a $200 defense bond, for "a well organized and detailed presentation of the many new superior features of modern automatic gas ranges."

Contestants submitted papers on what they had seen and learned at the exposition of gas appliances and equipment. Judges for the contest were William W. Clark, editor of *GAS*; Harold Springborn, executive editor of *Gas Age*; and Elliott Taylor, editor of *American Gas Journal*.

Second prize of a $100 bond went to H. W. Nicolson, general superintendent of distribution, gas department, Public Service Electric & Gas Co., Newark, for his "achieve-

SHURSEAL SADDLES

SEAL 3 WAYS*



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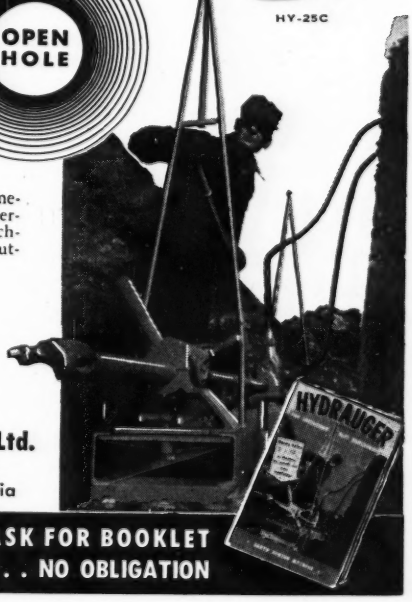

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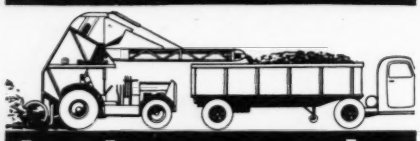
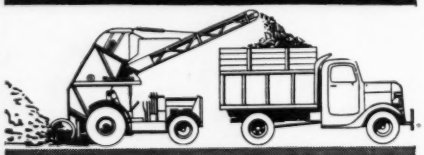


highest trucks



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ment in relating equipment developments to his company's operating problems." For his "success in visualizing the load building potentialities of new domestic gas equipment," Kenneth Fellows, secretary of Houston (Texas) Natural Gas Corp., was awarded third prize, a $50 bond. Merit awards consisting of $25 bonds were presented to 12 additional contestants for excellent papers.

Florida-Georgia gasmen to meet with Florida LPG men

Florida and Georgia gasmen will meet at the Palm Beach (Fla.) Biltmore hotel on April 16-18 for the joint convention of the Florida-Georgia Gas Assn. and the Florida L.P. Gas Assn. P. F. Haynes, Florida Public Utilities Co., representing the Florida-Georgia group, and Ben Wright, Hamilton Gas Corp., representing the L.P. gasmen, are convention chairmen of their respective organizations.

The program line-up includes talks by AGA President Frank Smith, who has for his subject "United for Action"; W. T. Trueblood, Magic Chef Inc., will tell attendants to "Sell the Features"; H. D. Valentine, Peoples Gas Light & Coke Co., will speak on "The Quick and the Dead", and Earle C. Clifford, Moore Publications, on "Education for Safety."

Other convention speakers will be Arthur C. Kreutzer, LPGA, "Relatively Speaking"; Carl Sorby, Geo. D. Roper Corp., "ICSS-OMF"; W. L. Hayes, Montana-Dakota Utilities Co., "Facing Up to the Facts"; and L. J. Fretwell, Oklahoma Natural Gas Co., "Meeting Electric Competition."

Material problems feature purchasing group's meeting

Purchasing agents, storekeepers, and stores' accountants will be in attendance at the Shroeder hotel in Milwaukee, April 13-15, for the conference of the American Gas Assn.'s purchasing and stores group. The committee, under the chairmanship of John C. Sims, Brooklyn Union Gas Co., has arranged a program that will include talks on material standardization, purchasing department operating manual, unusual applications of material handling equipment, standard packaging, and a round-table discussion of purchasing, stores, and related accounting problems.

C. Warner McVicar, director of purchasing and traffic of Rockwell Manufacturing Co., Pittsburgh, will discuss "The Value of a Purchasing Manual to Purchasing and Management." "A Standard Packing Report" will be reviewed by L. R. Michelsen, storekeeper of the Peoples Gas Light & Coke Co., Chicago.

H. T. Belcher, Consumers Power Co., Jackson, Mich., will present a review of "Material Standardization in the Gas Industry." Eugene S. Page, American Machine & Foundry Co., New York, will speak on "Organization and Development of a Standards Program" and Robert I. Highgate, Memphis Light, Gas & Water Division, will show a series of slides depicting unusual and unique ways of how handling equipment and its attachments save time and effort. Carl H. zur Nieden, Philadelphia (Pa.) Electric Co., will be moderator of the panel discussion.

Industrial and commercial men to have varied program

Along with all the other important meetings taking place this month, the AGA sales conference on industrial and commercial gas will be held at the Hotel Warwick in Philadelphia, April 13-15. Leaders in the gas industry and the gas equipment field, heads of related trade associations, and prominent industrialists will present subjects aimed at widening the perspective of industrial and commercial gasmen.

A panel discussion an automatic lighting with Terry Hart, chairman of the industrial and commercial gas section, serving as moderator, will highlight events on commercial gas day. In addition, Roy E. Wright, NEGEA Service Corp., will speak on "Fo It Fast!" and J. Fred Vollmer, president of the National Restaurant Assn., will speak on "As I See You."

Other speakers and their subjects: "Selling Performance," R. S. Chapman, Atlanta (Ga.) Gas Co.; "What the Dealer Thin

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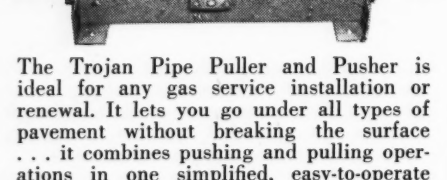

The Trojan Pipe Puller and Pusher is ideal for any gas service installation or renewal. It lets you go under all types of pavement without breaking the surface . . . it combines pushing and pulling operations in one simplified, easy-to-operate machine . . . and what's more, with its exclusive continuous action, it requires no resetting of the grip — cuts job time in half.

The Trojan Model B (shown above) handles pipe up to 2" in diameter without additional dogs, clamps or wedges. Constructed entirely of steel for sturdy, long-life service, it requires only a 5½' trench for operation, has 3 speeds for different types of soil, can be reversed in 30 seconds. You owe it to yourself to investigate this profit maker now!

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of a Commercial Cooking Campaign," Bryce C. Roby, president of Food Service Equipment Industry Inc.; and "What's Newest in Commercial Processing."

Tuesday will be devoted to general sessions, with presentations on the aims of industrial and commercial gas advertising and publicity, the future of industrial gas, and sales talks.

On industrial gas day (Wednesday), talks will be presented on "The Code of Ethics of Industrial Gas Equipment," high speed ink drying, the field for direct-fired spray drying, heat applications in the chemical industry, industrial gas equipment service as a sales aid, and gas applications in the glass industry.

Southern Gas convention emphasizes section confabs

Section meetings will be an important segment of the 45th annual convention of the Southern Gas Assn. to be held in New Orleans, May 11-13. Convention headquarters will be the Jung hotel, where all sessions will be held except those of the sales section, which will be at the Roosevelt hotel.

The accounting section, under the chairmanship of Louis G. James, Lone Star Gas Co., Dallas, has arranged for M. S. Crossley and J. R. Larimore, Consolidated Gas Utilities Corp., Oklahoma City, to present practical budgets for gas companies and James C. Messer, Peoples Gas Light & Coke Co., Chicago, to talk on "Are You Cost Conscious?"

Repair practices for domestic meters will be discussed by L. A. Bickel of Lone Star at the distribution section meeting and L. R. Pickup, Southern California Gas Co., will discuss plastic pipe.

An accident prevention forum will highlight the employee relations session.

Chairman of this year's general convention committee is Charles F. Stubbs, Alabama Gas Corp., Birmingham, with Curtis M. Smith, Tennessee Gas Transmission Co., Houston, and Charley Lockhart Jr., Bryant Heater Div., Dallas, vice chairman for gas companies and manufacturers, respectively.

General session speakers will be Sen. Everett M. Dirksen (R.-Ill.), who will speak at the Wednesday morning session, and Dr. Alfred P. Haake, noted economist and consultant to General Motors, who will address the Tuesday session.

Report on water heaters made by research group

Potential hazards of overheating have been evaluated and studies are being made on both steam and hot water relieving capacities of spillage type devices and on proper locations of various devices, it was revealed at a recent meeting of the inter-industry coordinating committee for temperature-pressure relief devices for storage water heaters.

The committee hopes to develop and publish, through research, authoritative and fac-

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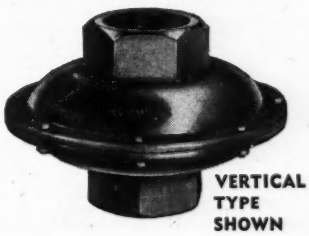

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Norwalk Diaphragm Type Check Valves both Vertical and Horizontal, provide positive check against reverse flow of either gas or air. Rugged construction will stand back pressures to 50 lbs. Soft seat disc will seat freely when gas flows in desired direction or will seat tightly on equalised or back pressure. Valves for higher pressures supplied on special order.

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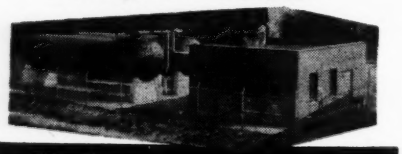

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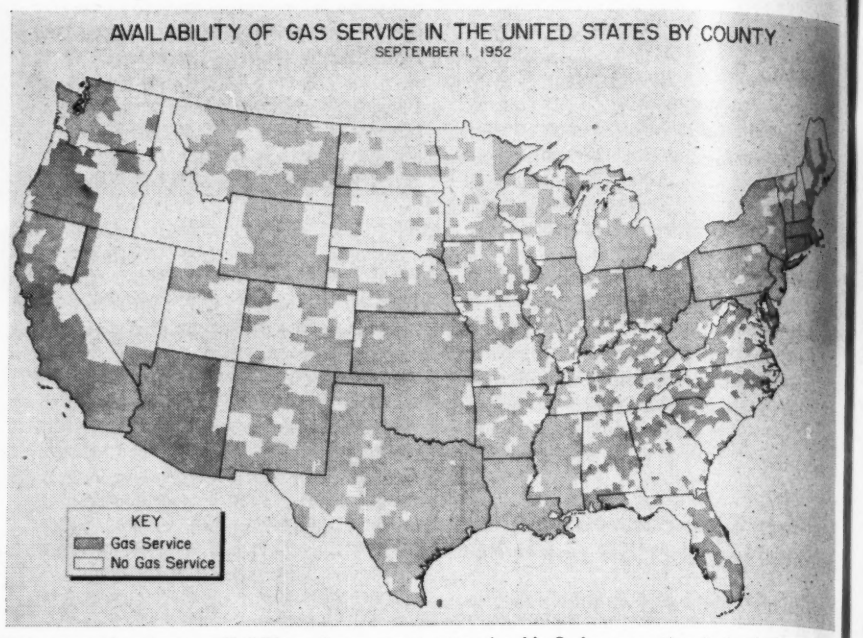

This map showing availability of gas service in the U. S. by counties is included in the new survey of residential gas users, characteristics of gas service, and approximate gas appliance saturations published by the bureau of statistics of the AGA. Information from the 1950 Housing Census together with statistics obtained from more than 425 utilities, representing 94% of the industry, provides a complete picture of the residential gas market, brought down to individual counties. The survey containing more than 280 pages of text, tables, and maps, is available from AGA. Price: $5 per copy.

tual information on high temperature relief devices and to make the information generally available to assist in standardizing various ordinances and building codes and to provide adequate domestic storage water heater protection.

The research staff of the AGA laboratories, assisting in the PAR-sponsored research project of the AGA committee on domestic gas research, has correlated all previous as well as current research. Probable effects of water composition, materials of construction, and location of devices on their fidelity of operation will also be covered in this work.

PAR committee appointed; Oates is chairman for 1953

James F. Oates Jr., chairman of the Peoples Gas Light & Coke Co., Chicago, is chairman of the 1953 PAR committee of the AGA. Stuart M. Crocker, chairman of Columbia Gas System Inc., New York, and C. H. Zachry, president of Southern Union Gas Co., Dallas, will serve as vice chairmen.

Other 1953 PAR committee members are: N. B. Bertolette, Hartford (Conn.) Gas Co.; Charles P. Crane, Consolidated Gas Electric Light & Power Co., Baltimore; R. E. Crawford, Minnesota Valley Natural Gas Co., Minneapolis; Hugh Cuthrell, Brooklyn (N. Y.) Union Gas Co.; H. Reid Derrick, Alabama Gas Corp., Birmingham; Henry Fink, American Natural Gas Co., Detroit; John C. Flanagan, United Gas Corp., Houston.

Ralph L. Fletcher, Providence (R. I.) Gas Co.; C. E. Gueffroy, Portland (Ore.) Gas & Coke Co.; J. K. Horton, Pacific Public Service Co., San Francisco; Wister H. Ligon, Nashville (Tenn.) Gas Co.; Duna C. Luce, Public Service Electric & Gas Co., Newark; J. F. Merriam, Northern Natural Gas Co., Omaha; Curtis Morris, Transcontinental Gas Pipe Line Corp., Houston.

Dean H. Mitchell, Northern Indiana Public Service Co., Hammond, Ind.; Karl B. Nagler, Peoples Gas Light & Coke Co., Chicago; Robert W. Otto, Laclede Gas Co., St. Louis; Jules D. Roberts, Mountain Fuel Supply Co., Salt Lake City; J. French Robinson, Consolidated Natural Gas Co., New York; W. T. Stevenson, Texas Gas Transmission Corp., Owensboro, Ky.; and Thomas Weir, Union Gas Co. of Canada Ltd., Chatham, Ont.

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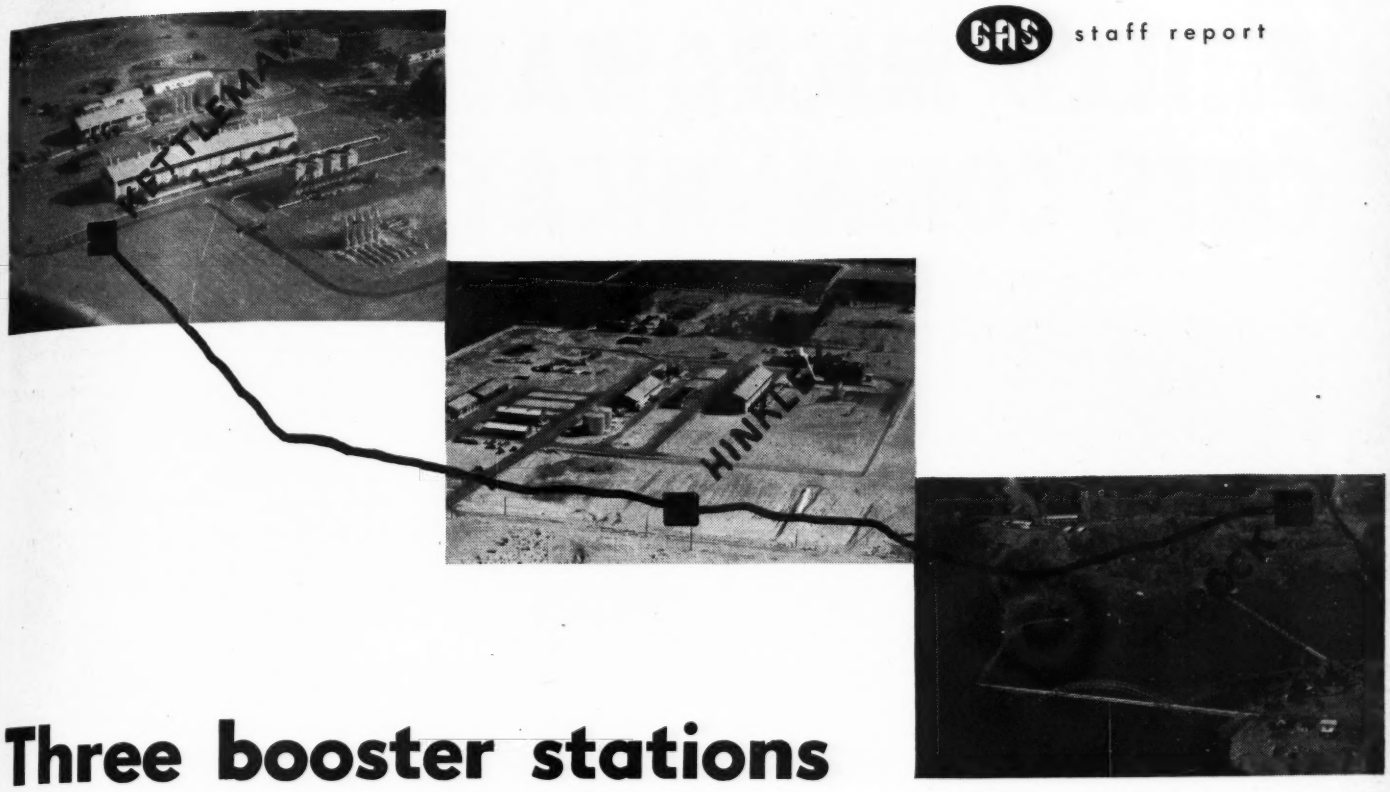
New attendance records forecast for GAMA meetin

More than 400 advance registrations hav been made for the annual meeting of th Gas Appliance Manufacturers Assn. to b held at White Sulphur Springs, W. Va., Ma 20-22, foretelling a breaking of existing a tendance records, according to GAMA's pro gram committee chairman, C. D. Lyford.

Division meetings and general session are on the program for the three-day affai and awards for meritorious service will b presented at the traditional president's din ner.



Three booster stations double "Super Inch" capacity

By BILL CLARK

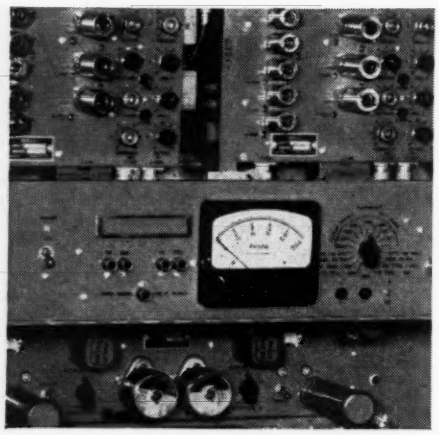
Kettleman station's main compressor building at night. Behind each vertical muffler is an air cleaner for each compressor housed in a boxlike shell to clean the air mixed with gas that fuels the compressor engines. The piping includes jacket cooling water and compressor gas fuel lines.

"THANKS to foresight and the state of Texas," read a recent wire story, California has plenty of gas for its fast-growing populace.

Figuring prominently in the picture is the present transmission construction program of Pacific Gas & Electric Co., principal gas supplier for the San Francisco Bay area and most of the more populous areas of northern and central California.

A dominant role in the story is played by the three key compressor stations on the so-called "Super Inch" line: Topock, located on the California side of the Colorado river across from Topock, Ariz.; Hinkley, in the desert near Barstow, Calif.; and Kettleman Hills, one of California's older gas-and-oil producing areas in the central valley 15 miles southeast of Coalinga. The present design capacity of the pipeline with compressor stations is 420 MMcf/day; additional looping and horsepower is now under construction to raise the capacity to 550 MMcf/day.

PHILCO MICROWAVE CUTS COMMUNICATIONS COST



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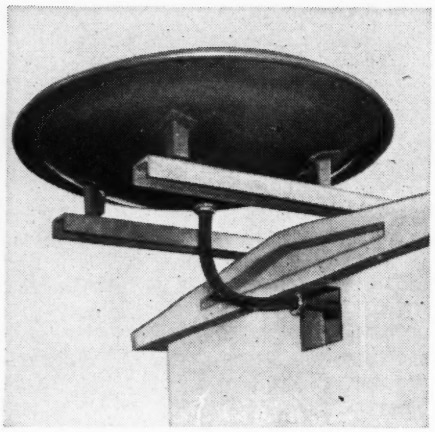

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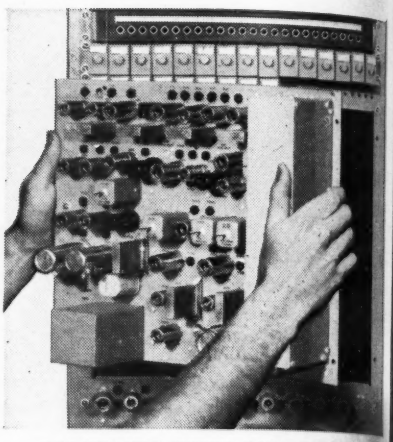
Tower climbing eliminated for routine checks since antennas are mounted at ground level, easily accessible for maintenance.



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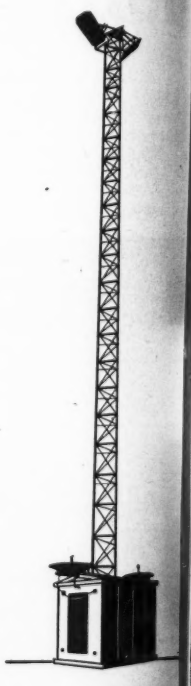
Field maintenance time and cost saved. All assemblies removable with only the use of a screwdriver for quick field replacement and depot checkout.

Reduce your communications cost with Philco microwave. Thousands of your communications dollars will be saved by the cost cutting features built into each Philco unit. Philco engineers know there is no substitute for quality and low maintenance cost.

That is why Philco microwave is built to Joint Army-Navy Specifications and why Philco's exclusive design slashes field maintenance time with built-in metering and test points on all major circuits . . . eliminates tower-climbing for routine checks with passive reflector-antenna system . . . allows quick field replacement of major assemblies with Philco's exclusive "packaged unit" components, removable with only a screwdriver.

Look to Philco microwave to cut your communications cost.



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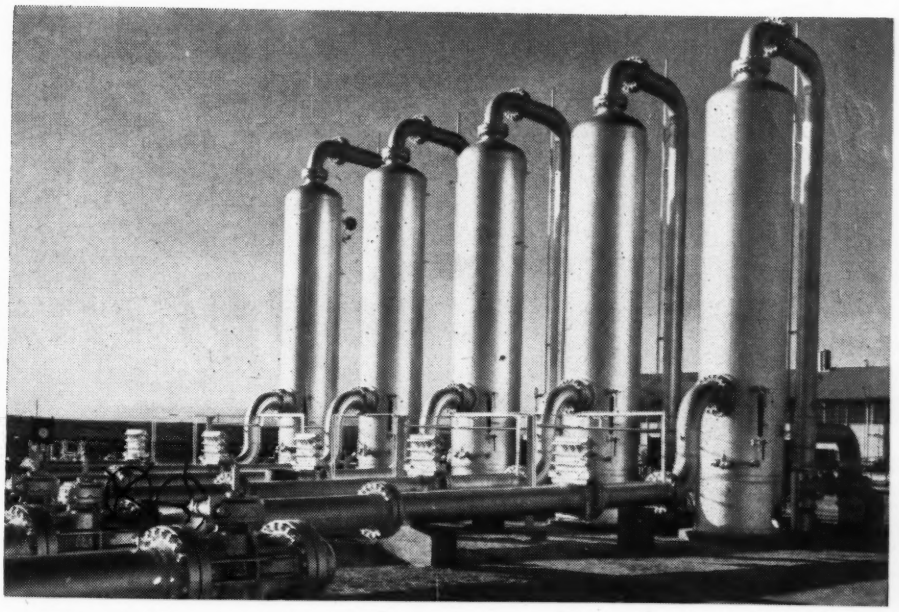
The stations were laid out so that they can be expanded enough to double station capacity. Topock and Hinkley are so arranged that station additions will duplicate the original pattern, in reverse (see diagrams).

At Kettleman, it was not feasible to use this type of construction so the station was built as two separate units, four compressors with appurtenant equipment, auxiliaries, and piping to a side. Additions will be made at either end.

Kettleman has an added feature of flexibility. Being located contiguous to an old station that compresses gas obtained locally, it can substitute for or augment the operations of its older brother. The so-called "hill" gas from local sources is compressed to 500 psi in the old station and passes into the Bay (20- and 22-in. series) and Stanpac



These scrubbers clean the gas at Kettleman before it enters the compressors.

Kettleman compressor station, aerial view.

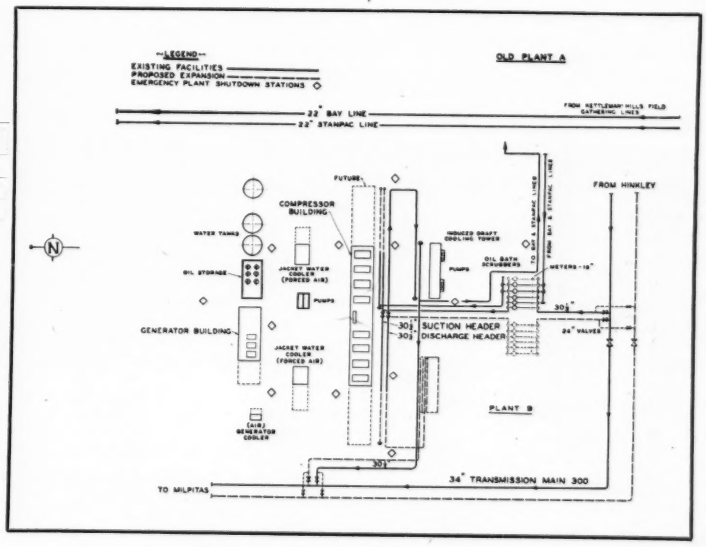
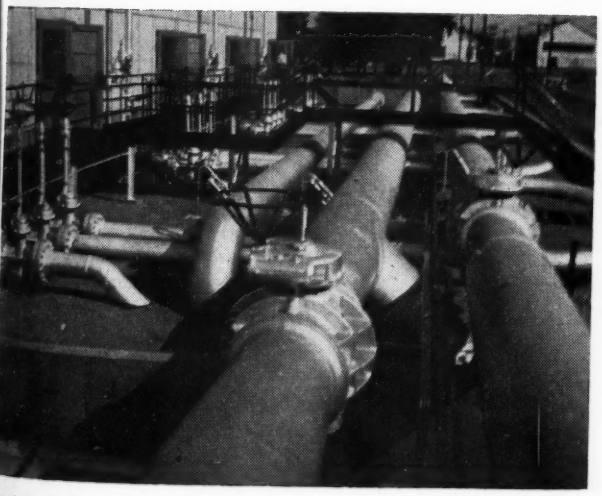
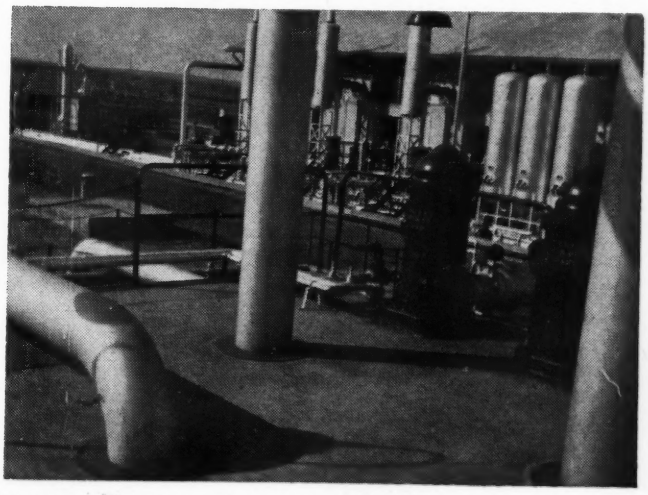


Diagram of the station layout.



At left is short 20-in. suction header for compressing Kettleman Hills gas. In the foreground are the 30½-in. discharge and suction headers with 24-in. gear-operated plug valves.



The hot and cold well showing the main jacket water pumps to the Clark units and the 16-in. main jacket water return lines and the 14-in. main lube oil cooling waterline.

SPACE-SAVING, FUEL-SAVING

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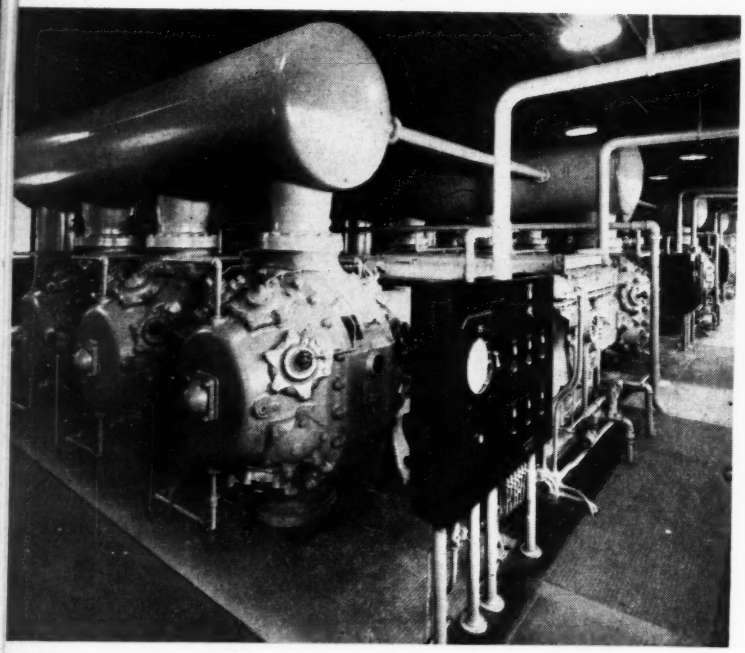
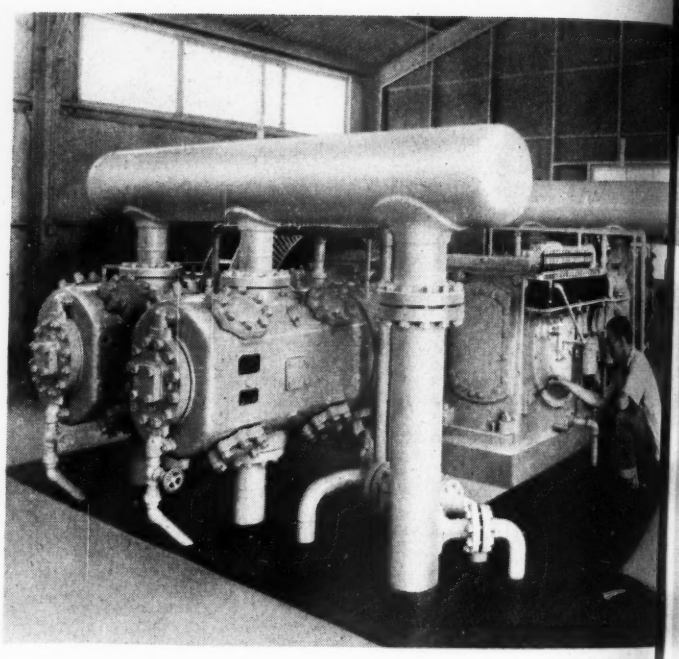
ON THE P. G. & E. SYSTEM





Above, left: Three Cooper-Bessemer 3,000-hp JM-6 motor-driven compressors in P. G. & E. Point Richmond distribution holder station. Above, right: Cooper-Bessemer 1000-hp FM-4 motor-driven compressor in North Sacramento station, for distribution and underground bottle storage service. Cooper-Bessemer units like these, totaling 17,350 horsepower, are used in six P. G. & E. stations for like service.

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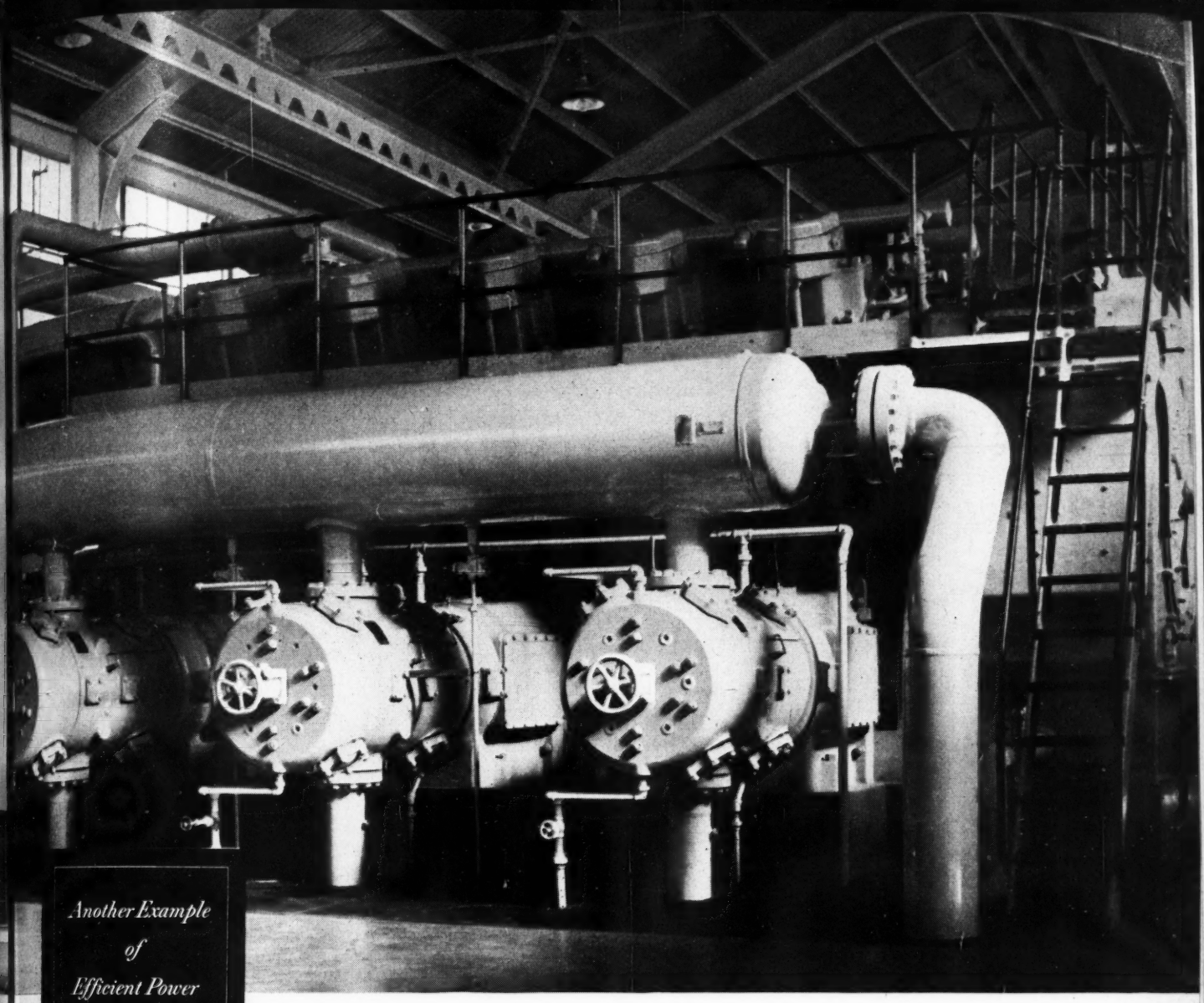

Another Example of Efficient Power at Lower Cost

Line-up of seven Cooper-Bessemer 2500-hp GMW V-angle units in P. G. & E. Hinkley compressor station on the Super Inch Line. The Topock station on the California-Arizona border is Cooper-Bessemer powered with six GMW-10's. These stations, together with a new Kettleman Hills station, have increased line capacity from 250 to 400 millions of cu. ft. per day.

As shown on these pages, modern Cooper-Bessemer compressors, both engine-driven V-angles and motor-driven units, are used in the Pacific Gas & Electric Company system.

On the company's Super Inch Line bringing gas from Texas, big GMW-10's pack low-cost compressor horsepower into relatively small space — six GMW's at the Topock station, seven at Hinkley. And at the third key compressor station, Kettleman Hills, seven 23-year-old Cooper-Bessemer Type 19 horizontals are still on the job, powering the original station serving the first two lines laid north to the San Francisco Bay area. All told, these units total 37,750 Cooper-Bessemer compressor horsepower on P. G. & E. gas transmission lines.

In addition, modern, compact motor-driven Cooper-Bessemer FM's and JM's, as shown at left, provide 17,350 compressor horsepower for distribution and storage services . . . at the company's Hollister, North Sacramento, Modesto, Fresno, Point Richmond and Potrero stations.

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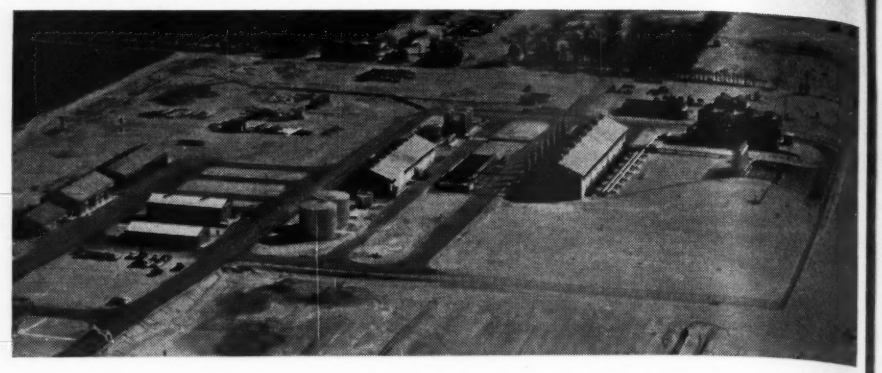
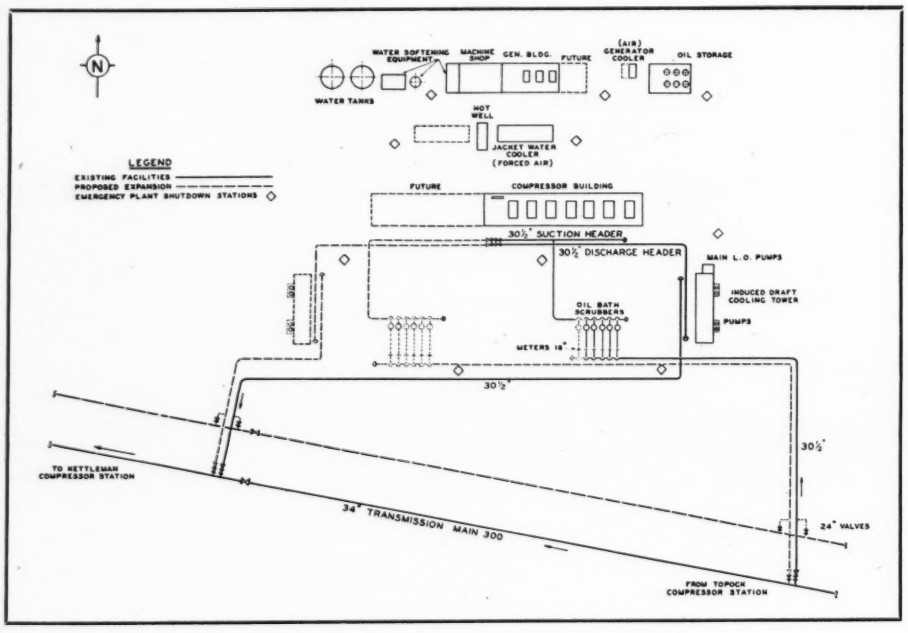
Aerial view of Hinkley station and diagram of plant layout.





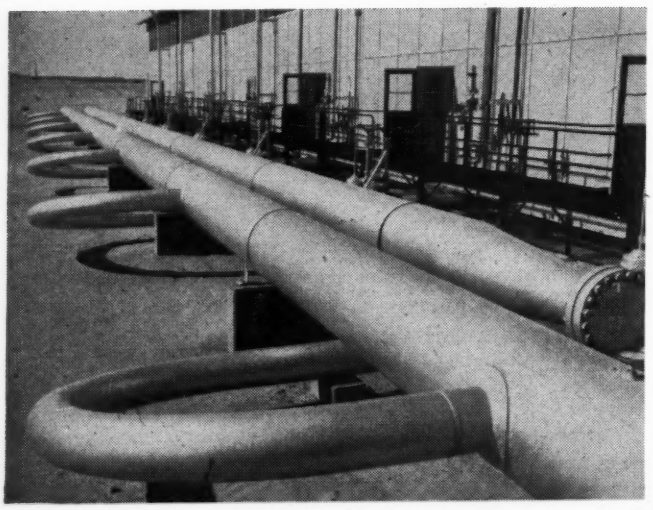
(22-, 24-, and 26-in. series) lines for delivery to PG&E's northern load centers. However, at the point where the "Kettleman gas" enters the station property, the lines are so valved and tied in with the new station that gas can be fed directly through the station or can be handled through one side of the compressor facilities (consisting of four compressors) or through both banks. If Kettleman gas were fed to a single bank, Texas gas could be compressed simultaneously in the other bank.

On the other hand, in an emergency the new station could be bypassed entirely and Texas gas coming in at 500 psi could be fed directly into the Stanpac and Bay lines with no compression.

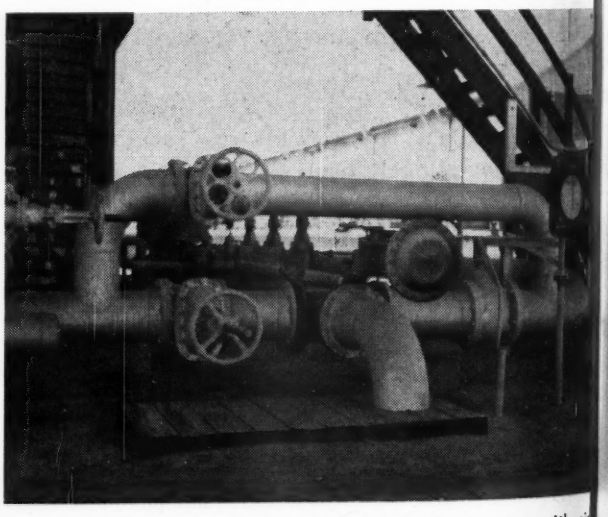
Interconnecting valves for the two stations will be remotely controlled from a separate metering and control building that coordinates the old plant and the new plant. Meter recorders used at points of operation are provided with transmitters to give duplicate recordings in the control building.

The interconnections at Kettleman were also helpful in getting Texas gas into the San Francisco Bay area well ahead of final construction of the project. The original line was completed as far as Kettleman Hills in October of 1950 and delivery of Texas gas began on a modest scale immediately, the gas being handled through the old station and into the old outgoing lines. This gave the company a jump of more than a month as the final section from Kettleman on through to the Milpitas measuring station (*GAS*, Dec. 1952, p. 39) was not completed until more than a month later.

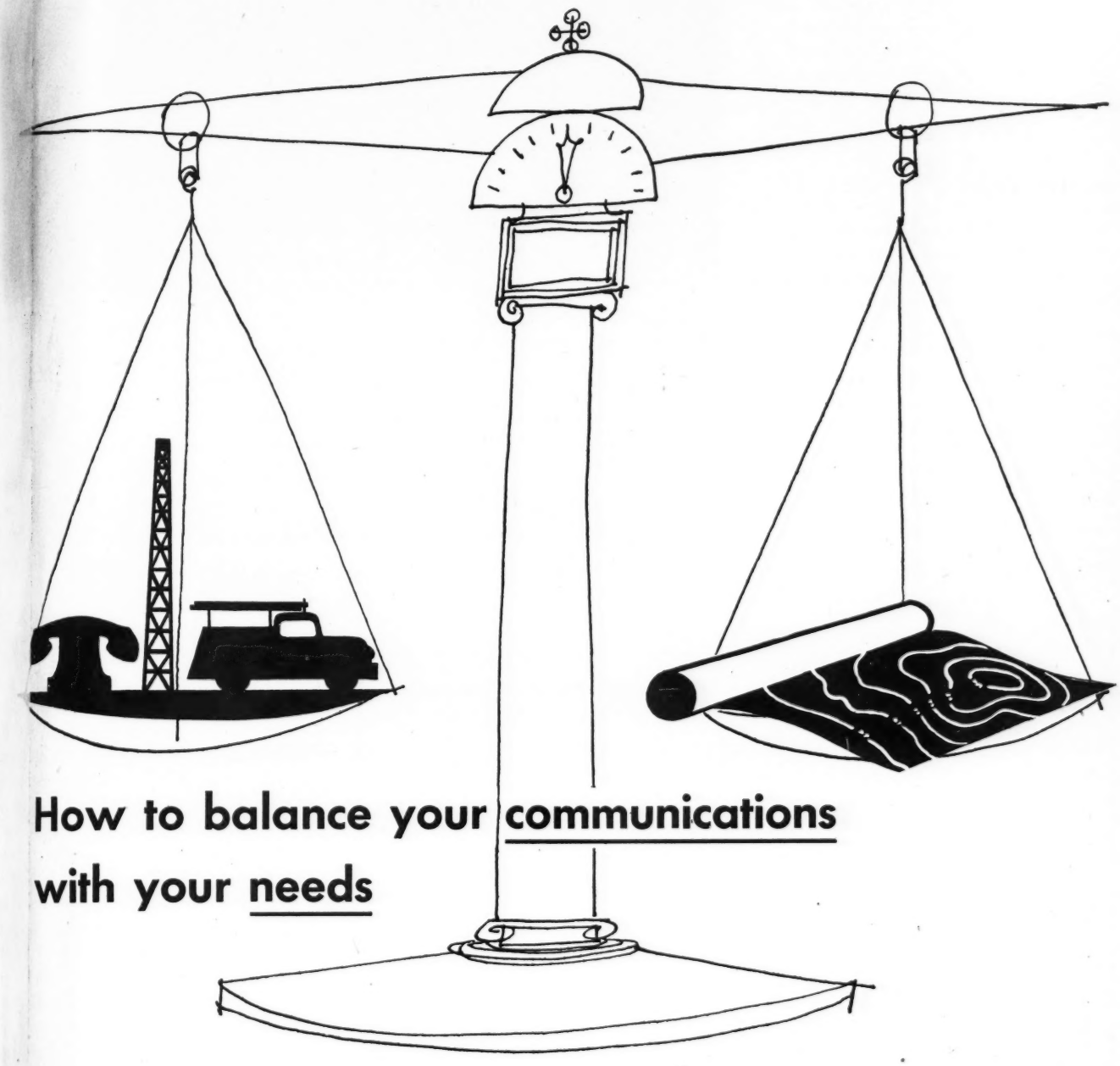
The Super Inch is the first high pressure natural gas pipeline of its size (34-in.) to be built. Initial input from the El Paso Natural Gas Co.'s line at the



Discharge side of main compressor building. Pipe on right is the intake or suction header and at left is the discharge header.



Bypass arrangement of main lube oil cooling water with air operated 3-way valve and controller located at cooling tower



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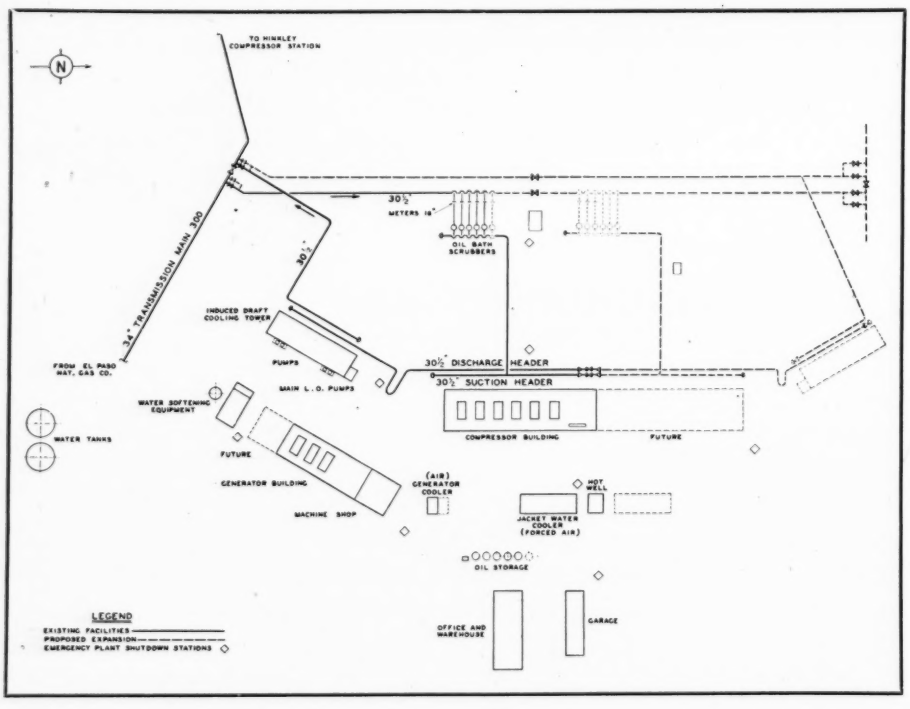
The starting point of PG&E's Super Inch line. At right is the community of Topock, Ariz. Topock compressor station is in background across the Colorado river. Delivery of Texas and New Mexico gas from El Paso transmission system is made at mid-stream. Below is a diagram of the station layout.



Topock connection was 250 MMcf per day. Received at a pressure approximating 650 psi, the gas underwent no compression throughout the length of PG&E's section of the line, arriving at the Milpitas terminal at a pressure just under 300 psi. When the three stations went on stream, capacity was boosted to 400 MMcf, the gas being delivered from El Paso at 500 psig. The addition of four 1760-hp Clark compressors on one side of the Kettleman station, three Cooper-Bessemer 2500-hp GMW's at Hinkley, and two Cooper-Bessemers of the same type at Topock this year will bring the capacity to 550 MMcf. An application is now on file before FPC to further increase capacity by additional looping and compressor horsepower.

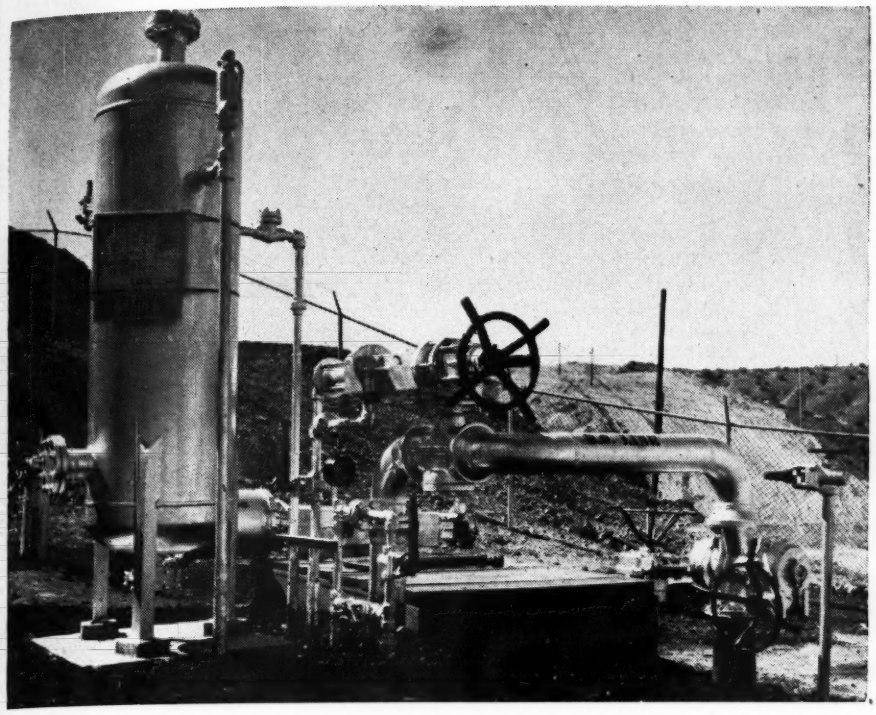
Kettleman has at present four 1760-hp Clark and four 1320-hp Ingersoll-Rand compressors, each operating in a separate bank. Present construction calls for new Clarks to be set up outboard of the present set of Clarks. Split operation is made possible through the valving of the suction and discharge headers between Clark and Ingersoll-Rand machines.

Physically, from the standpoints of equipment and layout, Topock and Hinkley are quite similar. At both these stations Cooper-Bessemer equipment is used —six compressors at Topock and seven at Hinkley. Gas from the 34-in. transmission main passes into and out of the stations through 30½-in. OD intake and discharge lines. The 30½-in. OD was used because Tube Turns prefabricated elbows of this dimension were readily available at the time. The gas is metered through 16-in. OD orifice tubes with Daniel senior orifice fittings and then flows to a bank of five Fluor oil-bath type dust scrubbers.

Since wall thicknesses along the line were graduated according to pressure needs to save on steel, pressure limiting stations had to be built at every point where there is a decrease in thickness. Two were built between Topock and Hinkley, three between Hinkley and Kettleman, and two between Kettleman and Milpitas.

Metering facilities have been included at all three compressor stations to permit close control of pipeline flow. Information recorded by only a single meter at each station is transmitted to the instrument panel in the compressor building; this serves as an indicator only. Information obtained from all orifice meters is gathered by the operators at the end of each day.

From the 30½-in. OD suction header, 12-in. lateral lines carry the gas to the compressors. (At Kettleman, 10-in. laterals are used.) At Topock, gas enters the station at 500 psi and is compressed to 800 psi. Gas piping in the three stations is designed for pressures up to 900 psi, even on the suction side, as a safeguard against possible bleedback. Intake and discharge were tested hydrostatically at 1½ times the working pressure. Pip



Air storage tank at Topock for plant emergency shutdown system. The blow-off line is in foreground and the pneumatic operator for the 24-in. discharge tie-in valve in background.

ing is so arranged that parallel flow is maintained in respect to batteries of scrubbers, cooling towers, jacket water coolers, and lube oil water coolers. This ensures uniform flow or pressure drip through all the units of each such battery.

Burgess-Manning pulsation bottles are attached to the intake and discharge flanges of the compressor cylinders.

Gas and lubricating oil cooling water are cooled in four-cell Fluor induced draft towers. Gas temperature at the compressor discharge is 160° to 180° F and is cooled to 10° above ground temperature before re-entering the pipeline. Design provides for cooling to 70° F in winter and 100° F in summer with a summer ambient air temperature of 115°.

Located below the gas coils in the cooling towers are the coils used for lube oil cooling water. Compressor engine oil temperatures average between 145° and 160° F. The lube oil cooling water circulates through a closed system, cooling the oil at individual engine heat exchangers and rejecting the heat in the tower coils. The temperature range for the lube oil cooling water is 120° to 130° F and circulation rate is 2600 gpm.

Jacket water is cooled in Marley forced draft Dri-Cooler units from 170° to 163° at a rate of about 10,000 gpm. Automatic temperature control, in addition to maintaining a constant water return temperature, alternates the use of the fans in the dry cooler to even out motor wear. Six units are used at Topock and Kettleman stations and seven at Hinkley, all for compressor engine service. Each station has one additional unit for auxiliary service.

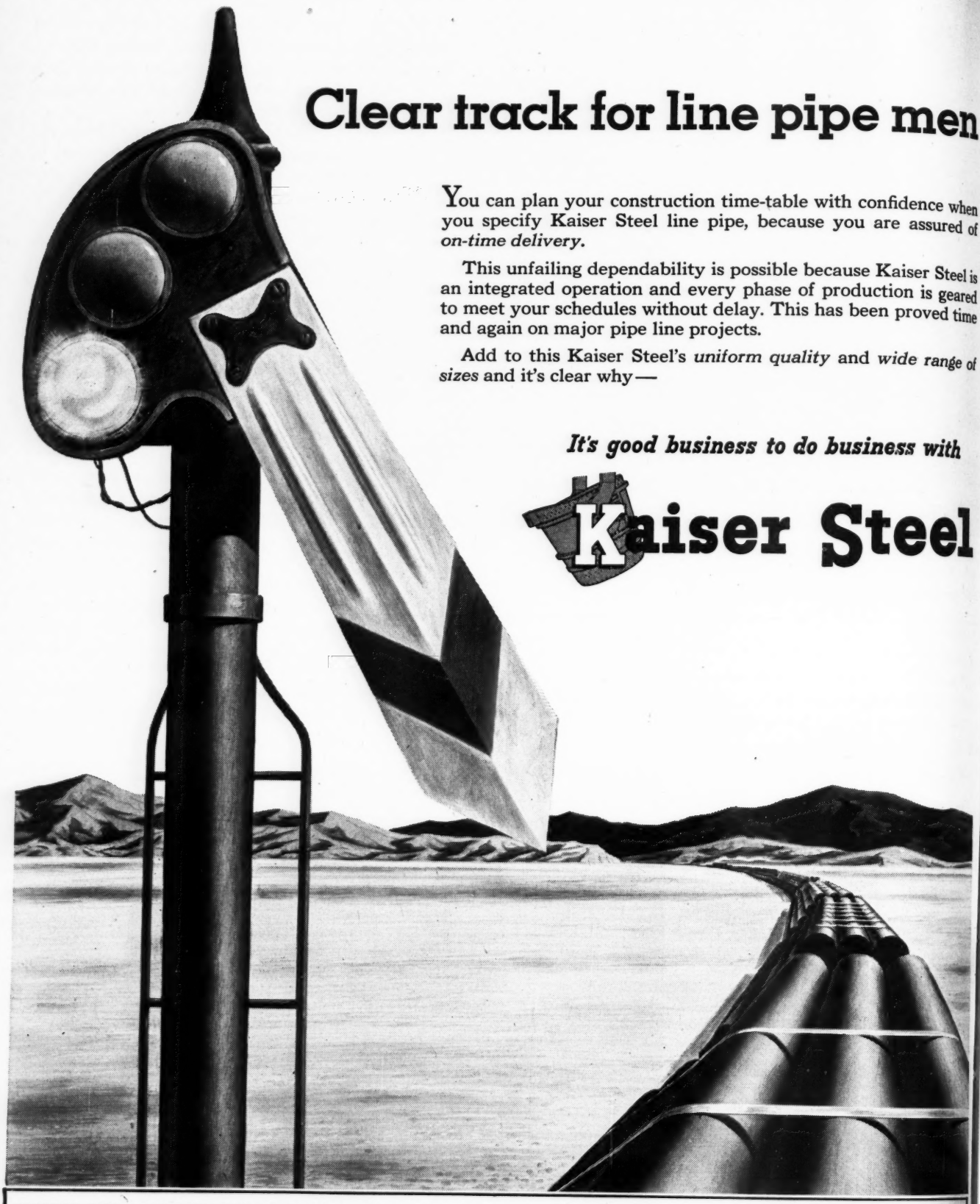
Station water is obtained from the company's own wells and is treated to ensure the proper chemical balance. Additives used for the purpose are injected through an aspirator. Permutit precipitators using the cold lime-soda process reduce the hardness of the water.

Circulation of jacket water is obtained with vertical turbine pumps mounted on the hotwell. Two pumps, each rated at 5000 gpm, operate to maintain the required circulation rate and a third is reserved as a spare. At Topock, Peerless pumps were installed, while at Hinkley and Kettleman, Layne & Bowler were selected. At Kettleman, where the engine banks are split, a common sump is used with one pump on either side operating for each bank of compressors. The pump in the center is used for standby, operating in place of either of the other two.

Auxiliary buildings at the three stations house electrical generators, air compressors and other auxiliary services. Three gas engine-driven Ingersoll-Rand 340-kw units at Topock and Hinkley supply all station power. At Kettleman, three Cooper 400-kw units supply only

This 34-in. drip installation is located on the 30-in. portion of the transmission main between El Paso terminal at the Colorado river and the suction side of Topock station.

Clear track for line pipe men



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Electric Resistance Weld—Plain End	5 9/16" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
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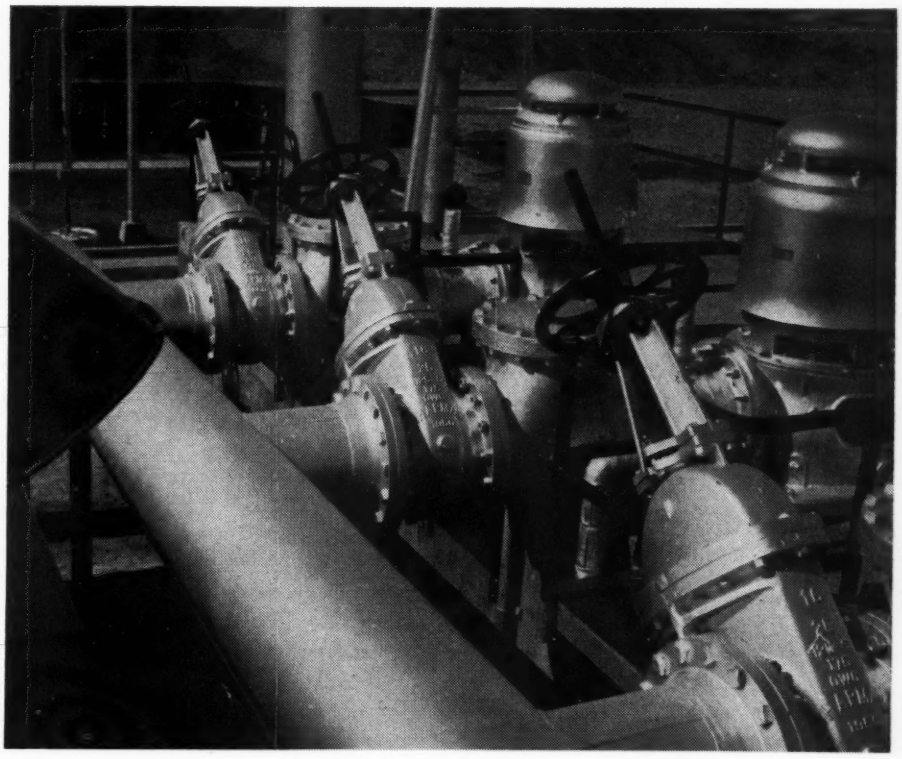


Five-hundred gpm 60-ft vertical turbine main jacket water pumps at hotwell showing the 16-in. discharge lines to the 20-in. header.

the power required to operate the new and old plants proper; the station is equipped to receive power from the company's own lines for use in offices and living quarters. At all three stations, two units handle the full design load leaving one as an alternate. Both the jacket water and lube oil cooling water for these engines are cooled in the auxiliary dry coolers.

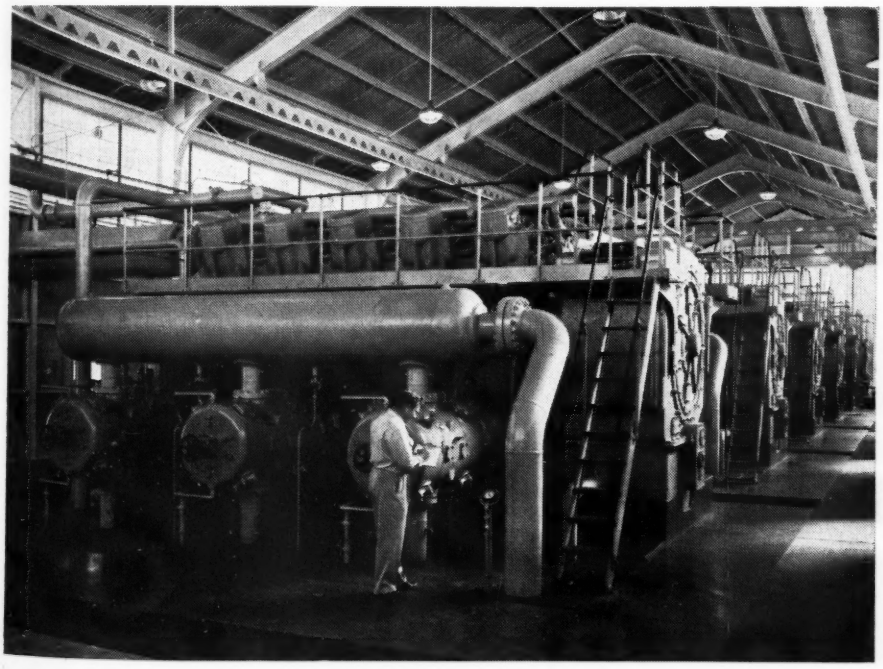
Starting air for the compressors at each station is obtained through a single Ingersoll-Rand electric motor-driven compressor, with one I-R gas engine-driven unit provided for standby. Three tanks store 2000 cu ft of air each, at 250 psig.

Fire protection is afforded by two 500-gpm fire pumps, one electrically driven, the other gas-driven. The latter can be switched over to burn gasoline in an emergency. Air for starting the engine-driven pump is taken from the plant starting air system. A check valve and separate storage tank soon will be installed to isolate the fire pump starting system so that a supply of air will always be available, even if the remainder of the station is down for any reason.

Shutdown stations located at convenient points around the perimeter and within the stations can be operated in an emergency to close off the station intake and discharge valves on the mainline, open the blow-down valves, and cut off the engine fuel. Fuel shutoff is used rather than ignition cutoff to reduce the danger of raw gas collecting and exploding in the mufflers when the engines are started up again.

Fire hydrants are usually located in conjunction with the shutdown stations. The fire pump may be started by push button control from any fire hydrant but once actuated can be stopped only at the pump installation itself.

Fuel gas to operate the stations' equipment is piped off the mainline downstream from the scrubbers and heated by water from the gas engine compressor jackets to prevent hydrate formation. All plant fuel is regulated to 100 psig and metered; for auxiliary equipment the pressure is further reduced to 1 psig.



Interior view of the Topock station showing six 2500-bhp compressors. The horizontal cylinder over the man's head is the intake pulsation dampner. Gas entering the compressor passes a series of baffles in this cylinder that prevents pulsations from being carried back into piping. The three horizontal cylinders extending out from the compressor are the compression cylinders and at top of the compressors are the cylinders of the compressor engine.

Cooling engines by ebullition*

Two phenomena—the latent heat of evaporation, with its tremendous powers of cooling, and the simplicity and positive action of thermal circulation—led the author and his associates to develop this new method of compressor engine cooling.

* "Boiling in the jackets"

By **O. B. FREEMAN** • Tide Water Associated Oil Co., Ventura, Calif.

THE two methods of combustion engine cooling in present use—the conventional method of low temperature direct heat transfer and the less widely applied system of direct interfacial heat transfer in liquid phase cooling above the boiling point—have inherent weaknesses. In my opinion, the proper method of cooling heavy duty combustion engines is by ebullition, or boiling within the jackets.

We have made a number of studies to substantiate this theory, and while parts of our conclusions may be subject to revision as more data on boiling phenomena become available, we are planning to increase the number of engines cooled by ebullition on our leases this year.

Throughout the years of combustion engine operation, conventional cooling has been of the low temperature direct heat transfer type. Another way of describing it would be to call it liquid phase cooling below the boiling point. With this method, water is pumped through the engine, picking up the waste heat that has not been dissipated through radiation or carried away in the exhaust gases. The water then passes to a radiator or cooling tower where the heat is removed and returns to the suction of the water pump, completing the cycle.

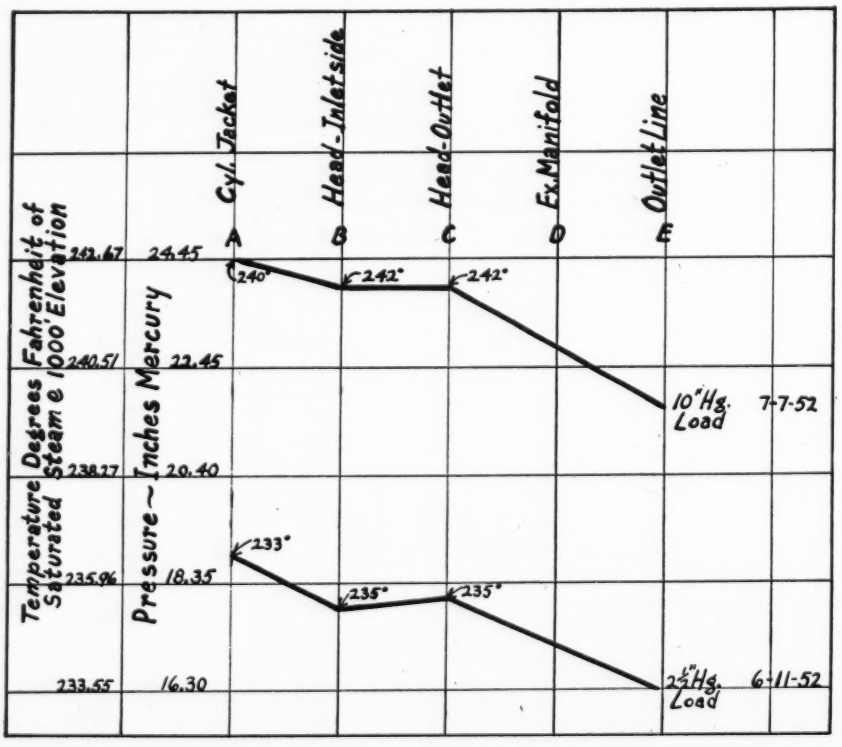


Fig. 1. Pressure drops across an XVG engine with new coolant outlet lines and no coolant pump.

Second method

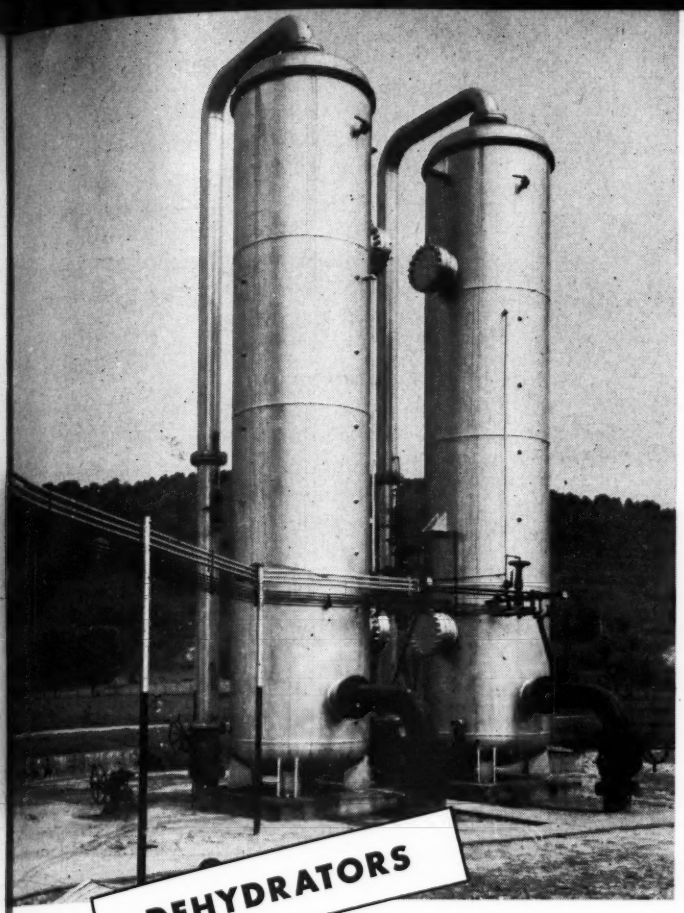
Some years ago, the second method of engine cooling came into rather limited use. Insofar as the engine is concerned, this system differs from the previously described one only in temperature elevation. It uses the same pump, circulating a similar amount of water with the same heat pickup and similar rise in coolant water temperatures.

The water, on leaving the engine, passes to a steam separator. Here a drop in pressure allows part of the water to flash to steam, thereby dissipating the heat picked up in the engine jackets. The remaining water leaves through the bottom of this separator and returns to the engine, completing the cycle. The steam escapes through the top of the separator and may be used for useful work or, if not needed, passes through a condenser. In either case, the condensate gravitates or is pumped back into the engine cooling system.

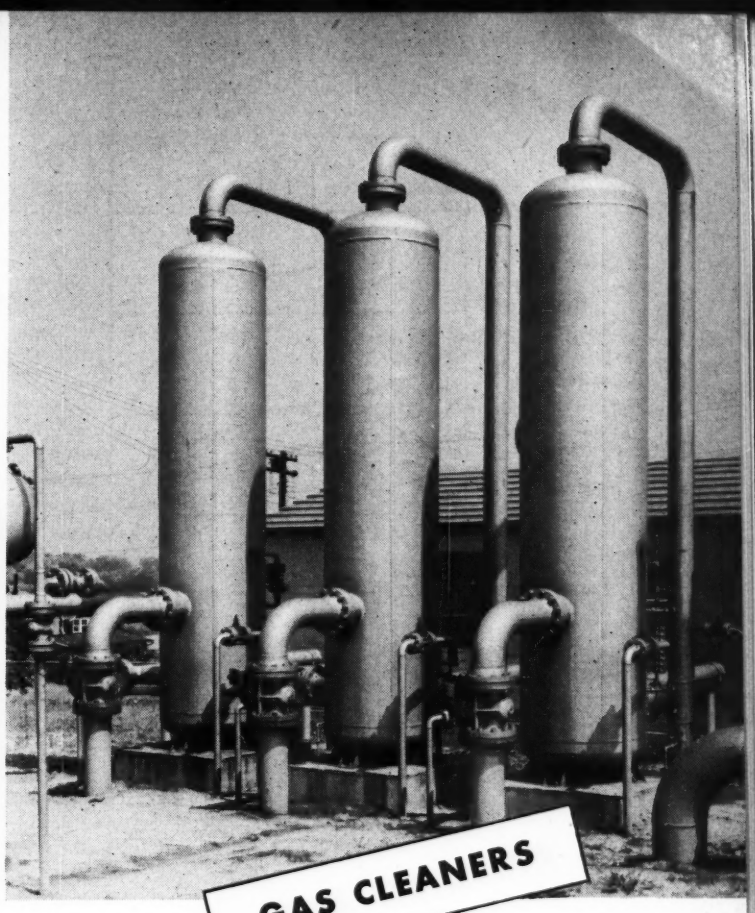
Methods have weaknesses

But these methods have their weaknesses. With radiator or tower cooling temperatures are always below the dew point with attendant formation of water sludge and acids in the crankcase; also overheating may result at high ambient air temperatures and high load conditions. Both methods are subject to pump and packing failure. Engines using either

This article has been adapted from a paper presented at a recent meeting of the California Natural Gasoline Assn.



DEHYDRATORS



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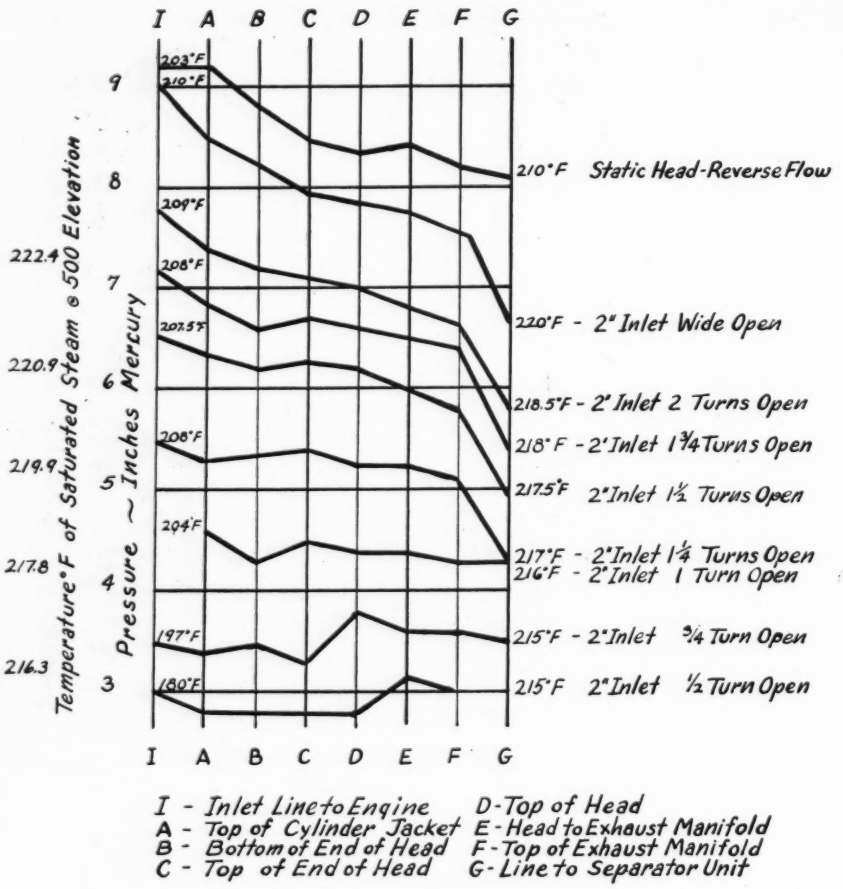


Fig. 2. Pressure drops across MGM 605-cu-ft engine under varying circulation rates produced by different inlet heads.

system have a tendency to detonate and lose power if temperatures are elevated much above the design temperatures.

Owing to lack of turbulence in the jacket water, there is a high temperature differential along the cylinder axis. This produces a decided taper to the cylinders when hot. Also, the water tends to stratify with a very hot layer of water next to the liner and much cooler water near the outer jacket. The result of this stratification is a heated liner trying to expand against a cooler jacket trying to maintain its original shape. These forces acting against each other produce high metal stresses and result in warping and distortion of the cylinder top.

High metal temperatures

Furthermore, with direct interfacial heat transfer, the transfer of heat from metal to water is very slow, resulting in high metal temperatures. Bad scale conditions within the cylinder jackets may cause these temperatures to reach serious elevations.

For the past several years, I have been of the opinion that the proper method of cooling heavy duty combustion engines was by ebullition, or boiling, within the jackets.

In exploring the possibilities of this type of cooling and in studying the problems involved, it was discovered that the water should enter the engine jackets at a very slow rate and that the use of mechanical energy or pumps was not desirable. From this discovery was born the second or twin idea that coolant circulation must be by thermal energy only. These two phenomena—(1) the latent heat of evaporation with its tremendous powers of cooling and (2) the simplicity and positive action of thermal circulation—are the basis of our experiments and development of cooling by ebullition.

Laboratory tests have shown heat transfer under boiling to vary from 5000 to 33,000 Btu/min. per sq ft. This is many times faster than by direct interfacial heat transfer and explains why we can elevate our coolant temperatures without any significant increase in wall temperature. Later in our investigations we found that in a compressor engine operating with low temperature direct heat transfer cooling with water pump functioning normally, we were unable to get steam bubbles to originate under any condition of loading and temperature, in either jackets or head. This might be caused, in part, by the thin film of superheated water being washed off the liner interface by high velocity water passing through the jackets.

Low attraction

Because of the low attraction of iron for water, the amount of superheating is low, being in the range of 17 to 27°. This temperature elevation, however, is essential to overcome interfacial attraction and permit initiation, growth, and separation of the steam bubble from the metal.

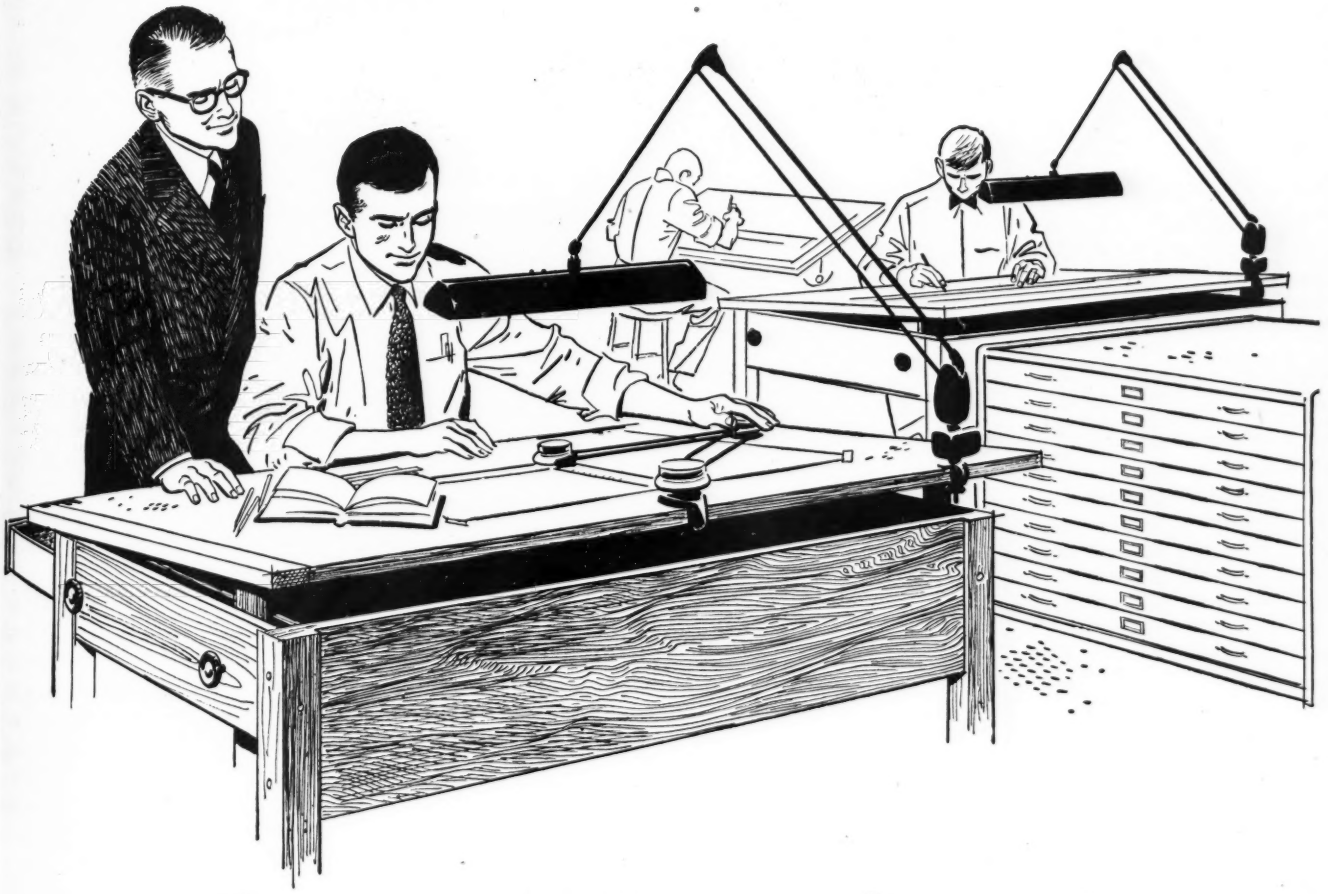
In the same compressor engine when starting up cold without water pump, steam bubbles were observed on the walls when mean discharge temperature from the engine was under 140° F. Established boiling occurred at mean discharge temperature of slightly above 150° F. This indicated a definite time element or water velocity through the engine if boiling is to be achieved.

As a result of this set of studies we are of the opinion that no boiling will occur at any place in a cylinder jacket (in a modern engine) as long as a water pump is functioning properly. In our older machines where little effort was made toward streamlining and low temperature rise, steam pockets could, and no doubt did, occur.

Temperature rise decrease

In high temperature direct transfer cooling, a decrease in temperature rise to as much as 6° F is frequently obtained. This is usually thought to be a result of boiling within the entire engine jacket. Again, such thinking is basically unsound. If an engine has a normal temperature rise of 10° F and a rise of 6° with high temperature transfer, it would mean that the coolant was entering the engine at 6° below boiling point at existing pressure. To start boiling, a sufficient volume of heat must be picked up by direct heat transfer to bring the coolant to boiling point; in this case 60% of total available heat. The remaining heat pickup will be through boiling transfer. Since much less than 60% of engine jacket water heat comes from the cylinder walls, all heat transfer in cylinder jacket will be direct heat transfer and temperature rise along cylinder axis will be less than 6° F. Remainder of heat will be picked up in head and exhaust

RIGHT AT THE BEGINNING—



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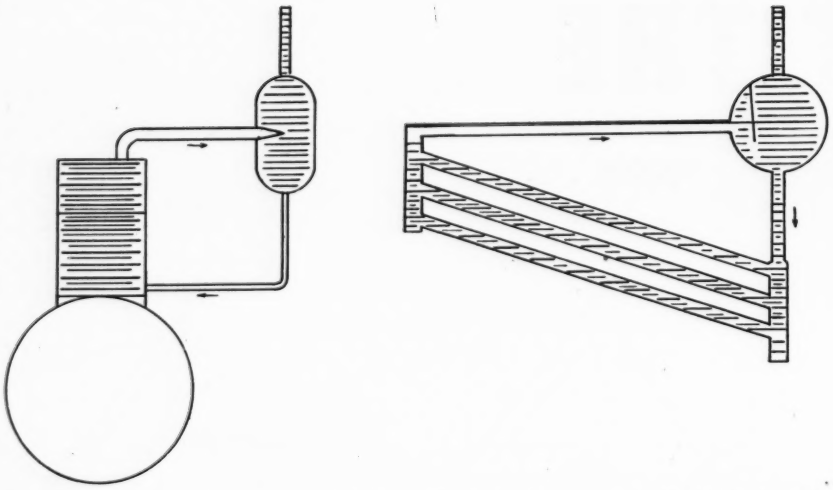

Fig. 3. Boiling heat comparison of internal combustion engine (left) and water tube boiler (right).

manifold. Cooling in head should be by both direct transfer and boiling. Cooling of exhaust manifold will be by boiling only.

Cooling by boiling heat transfer should produce a very low temperature rise across the engine, provided the plumbing system is designed with the idea of minimum heat loss through radiation. If this is done, coolant water is returned to the engine at a point so near the boiling temperature that agitation of a pump impeller would cause cavitation within the pump and severe damage to the engine. From this, we again find that mechanical energy is absolutely out of the question in cooling by ebullition. A further study of physical reactions within the jackets rules out the possibility of thermo-syphon circulation.

Difference in weight

Thermo-syphon circulation is a function of the difference in weight of two legs. That being the case, the application of this principle to engine cooling calls for a pressure drop across the engine of very nearly a straight line. With cooling by boiling, this is impossible. The origination, growth, and movement of steam bubbles produce a partial vacuum. As a result, pressures are lowered in the cylinder jacket and in the bottom of the cylinder head. A decided buildup in pressures will occur at the top of the head owing to steam backing up in trying to escape from the head through restricted openings. Upon leaving the head there should be an abrupt pressure drop. If a water cooled exhaust manifold is used, this rise and fall in pressure will be repeated by the steam in leaving the manifold. (See *Figs. 1* and *2*, showing typical pressure drops across two different engines, expressed as inches of mercury.)

Having eliminated mechanical energy and thermo-syphon for coolant circulation, we have left thermal energy only. And this energy must be produced within the body of the engine itself.

Water tube boilers

In our search for an application of thermal laws that would guarantee, through thermal energy, a sufficient or surplus quantity of water to cool an engine using latent heat of evaporation, we turned to the study of water tube boilers. In the single drum water tube boiler we found a condition we could very easily simulate in our engines. (See *Fig. 3.*)

In this boiler, steam is generated in a set of sloping tubes or legs installed within a fire box. In the generation and passage of steam up through these tubes, water is picked up and carried along in large quantities. At the top of these sloping tubes, horizontal lines carry steam and water to a drum. The large quantity of water necessitates installation of baffles in the drum in order to secure separation of water and steam. Steam escapes through the top of the drum and the water drops from the drum bottom through a second set of vertical tubes or legs to the bottom of the first or sloping legs, completing the cycle.

Visualizing the engine water jackets as the sloping tubes and the firing chamber of the cylinders as the fire box of the boiler, one needs only add a steam separator with enlarged line from the top of the engine to the separator and a second leg from the bottom of the separator to the engine water inlet and the picture is complete. The engine has been turned into almost an ideal water tube boiler insofar as circulation is concerned.

Since one purpose of this type of operation is recovery of waste heat from the engine, you may wish to install a water cooled exhaust manifold and an exhaust gas waste heat recovery unit. The question then arises, will it be possible to circulate sufficient water to care for all this heat?

Since the steam separator is installed above the engine, the jackets plus the vertical section of the discharge line become the lighter fluid leg. The line from the bottom of the separator to the engine then becomes the heavier or solid water leg. You now have a condition in which circulation becomes a function of the difference in density of the two legs. The velocity may be measured using the Torricellian formula, $V = \sqrt{2Gh}$, or for ordinary calculations, $V = 8\sqrt{h}$, h being measured in terms of the lighter fluid, in this case, steam.

Calculating circulation

Using this rule, circulation may be calculated fairly accurately provided no bad obstructions are allowed in the circulatory system. These calculations show a very large surplus of water carried over at low engine loadings. As the loading increases, the water carry-over decreases in almost direct ratio. Later on in our work we proved this under actual working conditions. (See *Fig. 4.*)

On a 150-bhp, 4-cylinder, 4-cycle compressor engine, using boiling heat transfer cooling, an orifice meter was installed on the solid water leg. Condensate was measured through another meter as it returned to the engine from the condenser. At 25% load, each pound of steam leaving the engine carried with it 85 lb of water; at 100% load, each pound of steam carried 18 lb of water; at the maximum loading of 117%, 13 lb of water was carried out by each pound of steam. Better streamlining of the engine jackets would increase the amount of water circulated per pound of steam at all conditions of loading.

These figures show a surprisingly close parallel with the circulation, percentage-wise, in a water tube boiler. They also show the impossibility of insufficient cooling water being brought into the engine at any loading. So after much study and paper work we came to the conclusion that cooling by ebullition was both feasible and practical.

On the strength of the above conclu-

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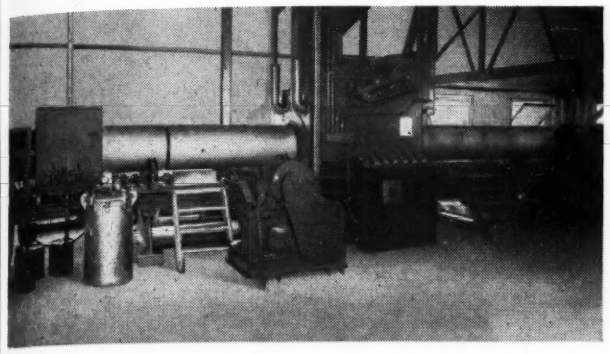

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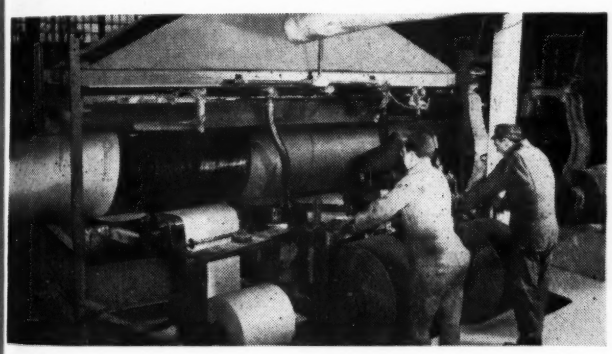

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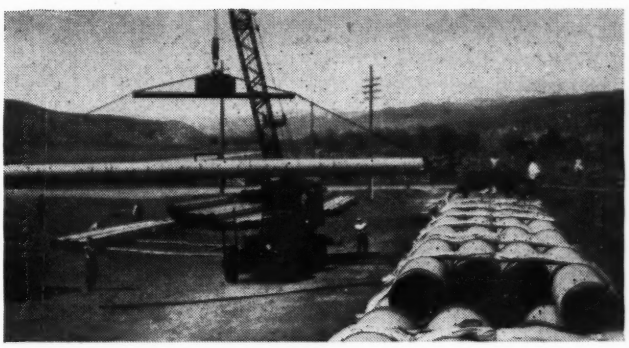

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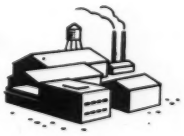

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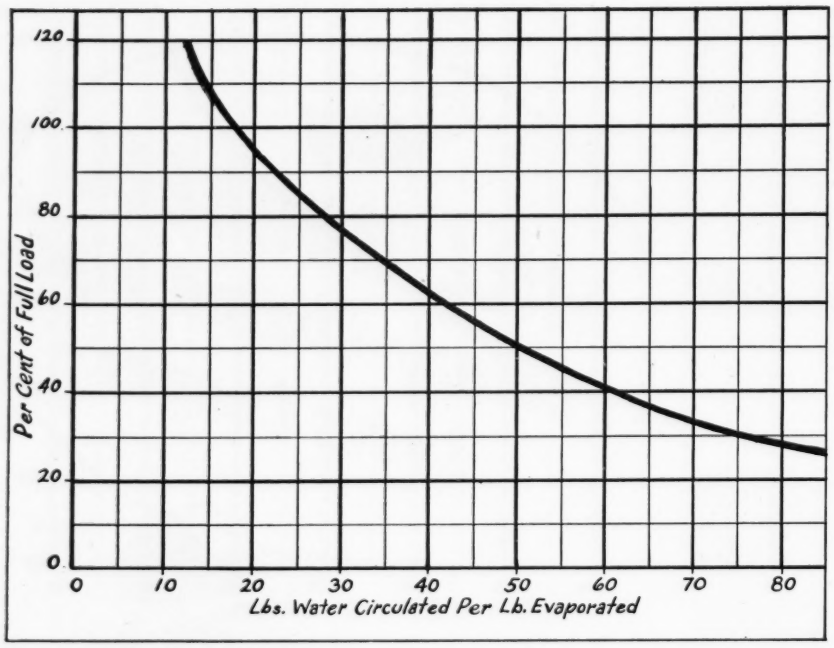

Fig. 4. Characteristic curve for circulation in 4-XVG engine by thermal action.

sions, it was decided to go ahead with actual tests. R. P. Bland of our company was placed in charge of running tests and correlation of observed results. We decided at this time that any engine under tests would be expected to hold up its end of the regular job at all times, that of producing oil. If at any time an overload was required, it would be applied. That rule has been consistently followed.

A 6-cylinder, 605-cu in., 4-cycle engine, pulling a Kobe Triplex pump was selected as the guinea pig. This engine operates normally on the API curve with a piston speed of 1000 ft per minute.

A vapor phase unit, or steam separator, was borrowed from Engineering Controls Inc. of Los Angeles. This unit was installed so it could be raised and lowered, enabling us to vary the heads on both legs. At various points in the cooling system where changes of pressure might occur holes were drilled and tapped. Cocks were installed so pressure readings could be taken.

Since temperatures above the boiling point become a function of pressure, no thermometer wells were installed other than in intake and discharge lines. Temperatures within the jackets were obtained from the steam table. To insure greater accuracy, mercury manometers were used instead of spring pressure gauges; pyrex nipples were installed on intake and discharge lines.

A series of studies was then started, using the engine pump to circulate the coolant. Curves showing pressure drops throughout the system were developed under various heads, volumes, and velocity conditions. On Nov. 28, 1951, the water pump was bypassed and the engine was put back in operation under normal working conditions.

Study continued

Studies of this machine were continued over a period of several months. Curves were plotted under many conditions. At one time, by use of an oil barrel for a reservoir, a minus zero intake head was achieved. At another time the engine was operated for three days, pulling a 40-bhp load while using a ¼-in. copper tube for a water intake line.

During this time, we were able to get a temperature rise of coolant across the engine of 1° F. First thought might be that in converting water at 212° into steam, there is no temperature rise, so rise across the engine should be zero. However, this would rule out radiation and would be perfection, and since perfection has never yet been achieved, we are satisfied with a 1° rise. Even so, on a similar engine but using an improved piping system, we were able at a later date to get a temperature rise of less than ½° F. This low temperature rise was obtained only when the cooling system was properly designed. (See *Figs. 5* and *6*).

Proper design is simple. It means placing the steam separator as near the engine as possible. Entrance into the separator should be approximately on a level with engine coolant outlet. An ample line should connect them to prevent unnecessary pressure buildup within the engine jackets. A small water line from the separator to the bottom of the engine is essential. Return condensate to steam line leaving engine instead of to water line entering engine.

The small line from separator to engine will reduce radiation losses and temperature rise across the engine. Since the condensate may return quite cool, admitting it on intake side of engine would tend to cool the entering jacket water and create increased rise across the engine. The condensate, if admitted to the steam and water line leaving the engine, will pick up heat from the steam without affecting temperature of the mixture.

Eventually we felt we had sufficient working proof of the soundness of this type of cooling to warrant installation on heavier equipment, so we proceeded to put a gas engine-driven compressor on a similar cooling system. This was a 4-cycle, 4-cylinder 11 by 12-in. engine developing 150 bhp at 4.5-in. manifold mercury depression and 350 rpm. Whereas the original test engine had been set to operate at, or slightly above, atmospheric pressure, the "separation unit" on the compressor was set to hold a pressure of 10 lb or 240° F on the engine jackets.

Pyrex glass windows were installed in a cylinder jacket wall, top and bottom over valve ports and the head at four locations, in exhaust manifold cooling jacket and pyrex nipples in intake and discharge coolant lines. The water pump was also bypassed. This compressor was put back into operation on April 1, 1952.

Load changes

Since this compressor is used on well start-up service, it is subject to load changes from light to maximum overload at very frequent intervals. We have, this way, been able to study and photograph boiling phenomena under all kinds of loads and speeds. Evaluation of observed phenomena was the really difficult part of these operations.

Probably one of the most important factors confronting us is the one concerning which the least is known. That is cylinder liner temperature under boiling conditions. Liner temperatures have been plotted against coolant in both high and low temperature direct transfer cooling but insofar as I know, not under boi

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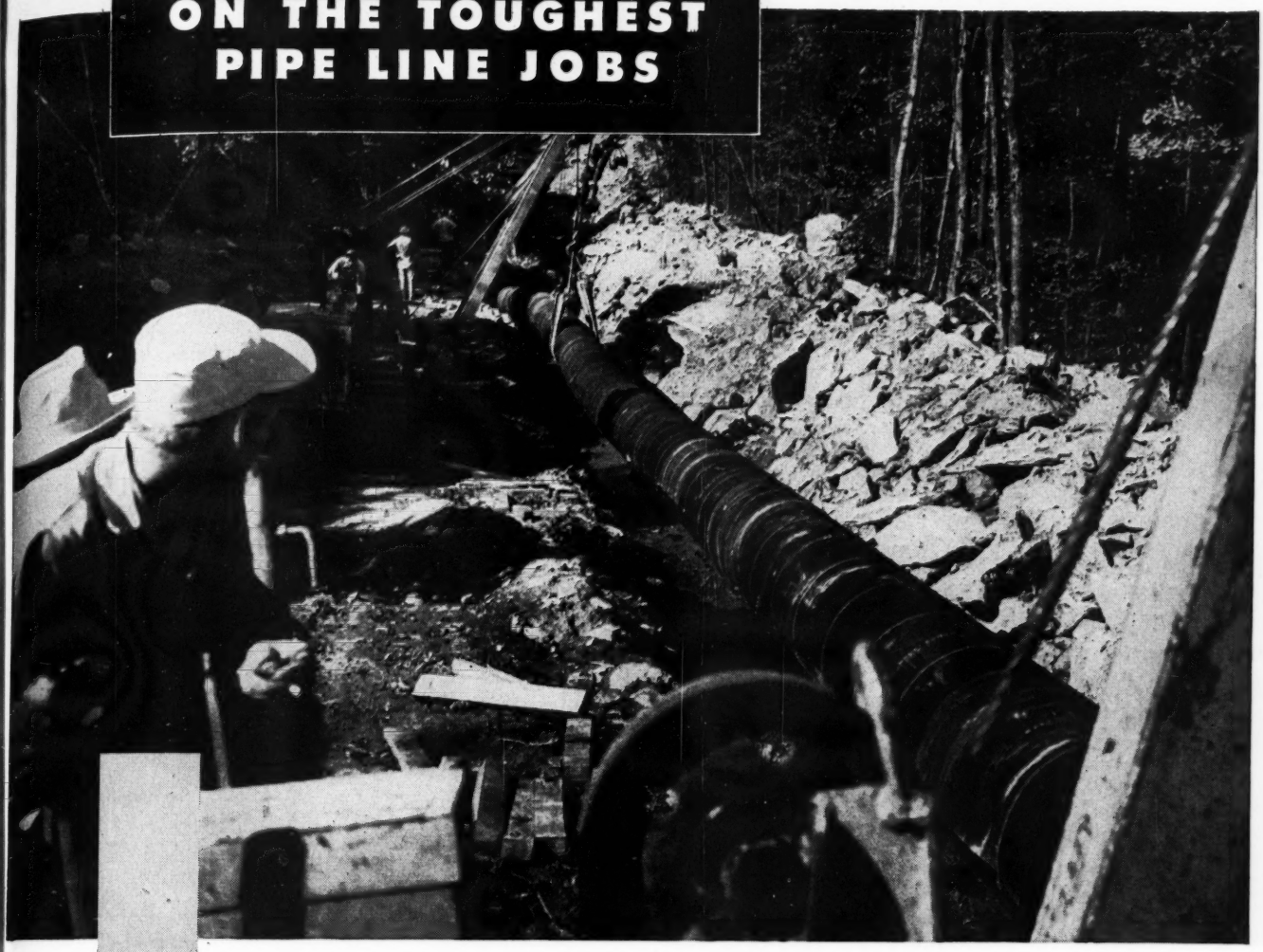

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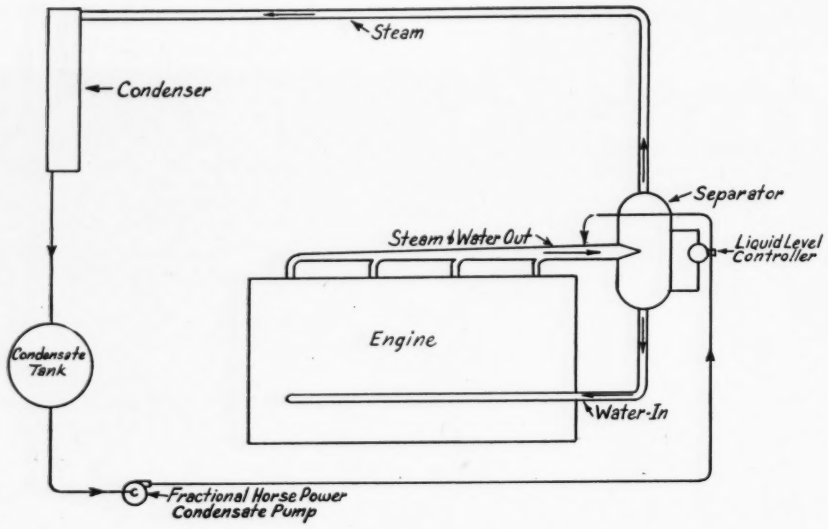

Fig. 5. Flow diagram of the ebullition cooling system.

ing transfer. It is my opinion that such study would show the cylinder liner to be straighter and more nearly round than under normal cooling. This would explain beyond doubt the reason we are getting more power and smoother operation in our engines cooled by boiling.

When studying boiling heat transfer, we learn that under established boiling conditions the interfacial heat transfer from a metal to a liquid is many times faster than under direct heat transfer. This greater speed of heat transfer leads to the very reasonable assumption that we are very materially lowering our metal temperatures.

We also learn that regardless of the metal temperature during growth of a steam bubble, upon separation of the bubble from the metal the metal cannot be re-wet until it has locally dropped to the temperature of evaporation at existing pressures. Since we have observed, and our cylinder jacket photos have shown, established boiling over the full length of the liner, it cannot be denied that such liner temperature is uniform and at low elevation along its entire axis.

Temperature change

A slight change in upper and lower cylinder wall temperature will be found owing to varying differentials between wall temperatures and super-heat of water at different cylinder positions. The amount of this variation could be shown by different values, when applied at varying cylinder elevations, of the boiling equation $(t_1 - Tsat)$, where t_1 is inner liner temperature and Tsat is the saturation temperature of the liquid at existing pressure.

Since no bubble can be formed until the liquid film adjacent to the liner wall has been super-heated to a point above the saturation temperature, similar temperature condition will exist along the entire cylinder length if full boiling is to be established. Again it is easily seen that with boiling along the entire cylinder liner, such as we observe under full load, a uniformly true cylinder is maintained. Apparently, this in large measure explains our increase in horsepower and smoothness of operation. Since the function of the equation $(t_1 - Tsat)$ is to control the amount of heat transfer by controlling the number, rapidity of growth, and size of bubbles formed under full engine load, this equation will be functioning along the entire cylinder axis. And again uniformity of liner is indicated.

Under very light load, or with poor piping, boiling at the bottom would not occur. Heat transfer would be by direct interfacial action. In that event the above conclusions would not be entirely true. We should, however, be able to neglect this light load condition as the loaded engine is the one in which operators are most vitally interested.

A study of the foregoing leads to the thought that we are splitting hairs as regards temperature elevations. That is true—in our operations we consider 1° F as a normal temperature rise across the engine—even 1½ or 2° we consider excessive. The above theories have led us to the belief that under boiling heat transfer our liner temperatures are normal at all times.

Belief strengthened

Several reactions have occurred in our engines under boiling phenomena that strengthen this belief. First, in extremely elevated temperatures up to 270° F, no detonating or loss of power occurred. Second, our crankcase temperatures remain normal at around 180° F. Furthermore, the crankcase temperature does not appear to be affected either by engine coolant temperature or engine loading, but it is affected by ambient air temperature. As a result, we have removed all oil coolers on engines cooled by boiling heat transfer. This has been possible because all these engines are of the dry piston type. With oil cooled pistons, it would be necessary to cool the oil. Cooling of the oil would, of course, need to be from some source other than the engine coolant.

In our low temperature compressor engines we maintain a load limit of, or near to, the manufacturer's rating. On our compressors operating under boiling phenomena, the limits have been removed, loading being left to the discretion of the plant operators. As a result the operators are now loading these en

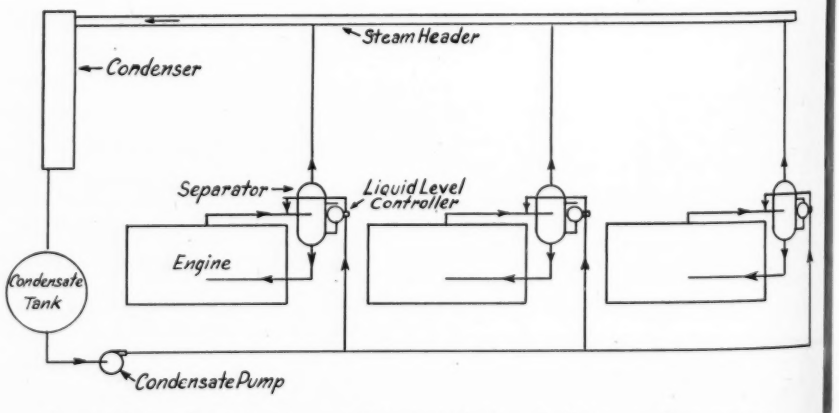

Fig. 6. Flow diagram of a multiple installation ebullition cooling system.

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gines up to 117% of their rated horsepower. A loading of 110% is considered safe and economical for 24-hour-per-day operation.

The value of any new method of operation should be measured in terms of cost, changes in efficiency, operating cost, and life of equipment. This last cannot be evaluated at this time for ebullition cooling.

When cooling by ebullition is compared with low temperature cooling, the first cost is favorable. On certain installations the first cost may be as much as 35% under conventional methods. In no stationary equipment should the costs be greater, and when compared with high temperature direct heat transfer cooling, the first costs will be about the same.

Savings in operating costs when cooling by ebullition as compared with cooling towers and radiator maintenance and operation is considerable. Cleaner engines, top and bottom, and less carbon deposits are other achievements. Noteworthy also is the fact that when using heavy duty lubricants, little or no deposit of ash occurs on valves, valve stems, and cylinder or piston heads.

Thermal efficiency increase

In addition to these, we have an increase in thermal efficiency of around 40%. This increase is in the form of steam or waste heat recovered. We are using this steam to do useful work. Steam from our compressors is currently being used in heating crude oil preparatory to dehydration. Steam from Kobe prime movers is being used to heat power oil and thereby reduce waxing in the pipelines. Each such installation has resulted in a partial or complete elimination of a boiler plant or direct-fired heater. As a result, we are looking forward to increasing the number of engines cooled by ebullition on our leases this year.

In view of the limited amount of data available regarding boiling phenomena, it is only reasonable to suppose that parts of our conclusions may be subject to revision. A careful and accurate study of engine liner temperature under boiling heat transfer would probably be of more value than anything else. Such study would need to include wet and dry liners in both 2- and 4-cycle engines, in both spark ignition and diesel cycle.

Until more information of such nature is available, we will of necessity be restricted more or less to empirical tests for increased efficiency in our operations.

PIPELINE NEWS

Complete Southern Natural expansion plan approved

A decision authorizing the entire expansion program proposed by Southern Natural Gas Co., Birmingham, has finally been filed by FPC. The new facilities, estimated to cost $44,932,600, will increase the company's daily delivery capacity from 670 MMcf to 1020 MMcf. The decision also authorizes construction programs for South Carolina Natural Gas Co., Columbia, and South Georgia Natural Gas Co., Birmingham, Ala. that will enable them to accept delivery of natural gas from Southern Natural.

The long-awaited approval covers 522 miles of additions to the company's system with 9800 hp additional compressor capacity, and 270 miles of new pipeline and a new 4400-hp compressor station. About 109 miles of this line was previously authorized. These facilities will extend Southern's system from its present southeastern terminus near Bass Junction, Ga., to Aiken, S. C. and Savannah, Ga. Besides the South Carolina and South Georgia companies, new customers to be served include 17 communities in Alabama and Georgia; the Southeast Alabama Gas District, which will build a system to enable it to accept delivery from Southern; and South Atlantic Gas Co., which now distributes manufactured gas in Savannah. Seven direct industrial customers will also be served, and five other Georgia communities as directed by the FPC order.

An amended application asking authorization to install 16-in. pipe, rather than the 10¾- and 8⅝-in. authorized in 1950, was granted for a line to serve several communities and industrial customers in Georgia and South Carolina.

A supply system extending south from a connection with Southern's lines at Gwinville, Miss. to existing lines in the Gulf of Mexico and including more than 326 miles of line and 8700-hp of compressor capacity was authorized last October. Estimated cost of this phase of the program is $32,518,500.

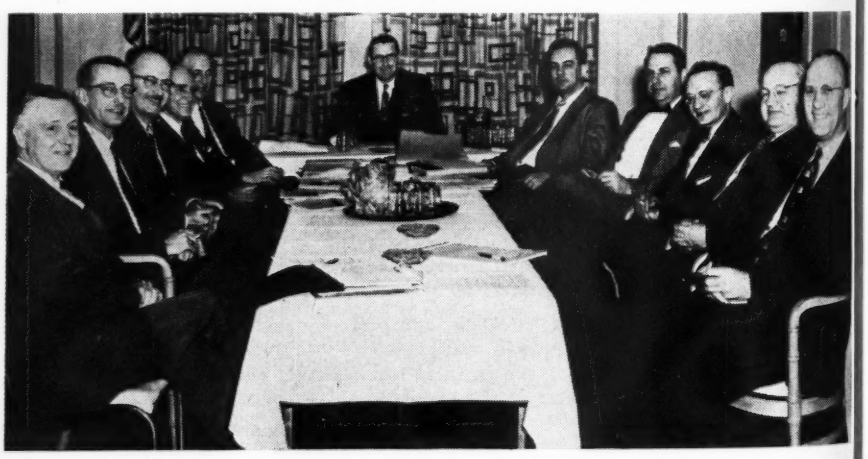
Facilities to be constructed by South Georgia Natural Gas Co. include 335 miles of line extending southeast from a point on Southern's system in Lee county, Ala. through southwestern Georgia and into Florida to serve five direct industrial customers and provide city gate natural gas service to eleven communities in Georgia and three in Florida. Capacity of the system will be about 20 MMcf per day. Estimated cost is $8,141,518.

South Carolina Natural Gas Co. will build about 160 miles of line extending southeast from the proposed eastern terminus of Southern's system near Aiken, S. C., to sell gas to South Carolina Electric & Gas Co., Columbia, at the city gates of Columbia, Charleston, and Summerville, S. C., and to the municipalities of Bamberg, Denmark, Orangeburg, and Walterboro. South Carolina plans to purchase 30 MMcf daily from Southern. Total cost of the project is estimated at $5,945,000.

Operating, technical men to attend transmission meet

The exchange of information and discussion of mutual problems on all phases of the natural gas industry will make up an important segment of the first transmission and storage conference of the AGA to be held at the Edgewater Beach hotel in Chicago, April 30-May 1, for operating and technical personnel engaged in producing, gathering, transmitting, and storing gas.

The program committee has arranged two types of conference sessions: the mornings of the two-day meeting will be devoted to



Program committee for the transmission and storage conference met recently to draft plans for the April meeting. Left to right: John M. McCaleb, Channing W. Wilson, F. A. Hough, Julian L. Foster, J. Stanford Setchell, Walter H. Davidson (chairman), Frederic Moshier, John V. Goodman, T. L. Robey, Charles F. deMey, and Joe T. Innis.

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One of a series on "America's Miracle . . . Free Enterprise in Action," this ad appeared in a recent issue of the Los Angeles Times, telling the story of Fluor Corp. Ltd. According to Fluor, the response was good locally, and a number of people have remarked that they now know what Fluor is and does, having no previous idea of the company's business or its size.

general sessions and afternoon meetings will comprise informal, off-the-record discussion conferences. Walter H. Davidson, Transcontinental Gas Pipe Line Corp., Houston, newly elected vice chairman of the AGA operating section, will preside at the general sessions.

Following the welcoming address by AGA President Frank C. Smith, in which he will explain the benefits to natural gas companies resulting from the streamlining of the AGA and its constitution and by-laws, R. A. Cattell, U. S. Bureau of Mines, will present a conservation award to the association for its cooperation with conservation activities of the Department of the Interior. Mr. Cattell will also discuss cooperative research activities.

Program highlights at the first general session will include a report of the work already completed by the subcommittee working on Section 8 of the revised ASA Code for Pressure Piping, presented by F. A. Hough, Southern Counties Gas Co., Los Angeles, chairman of the subcommittee. Causes of brittle fractures will be discussed by Prof. Earl R. Parker of the University of California and the development and operation of underground storage fields will be the subject of a talk by W. E. Ferguson, Ohio Fuel Gas Co., Columbus.

H. Carl Wolf, AGA managing director, will address the delegates at the second morning session. He will be followed by J. T. Innis, Northern Natural Gas Co., Omaha, who will review the natural gas research program. Mr. Innis is chairman of the AGA pipeline research committee. Dr. M. S. Viteles, Philadelphia (Pa.) Electric Co., will also address this session on the subject of selecting and training engineering personnel in the industry.

The second report on underground storage statistics will be presented and analyzed by John B. Corrin Jr., Hope Natural Gas Co., chairman of the subcommittee compiling the reports. Current developments in gas turbines and centrifugal compressors will be reviewed by D. K. Hutchcraft, Clark Bros. Co., Olean, N. Y. F. M. Banks, Southern California Gas Co., will close the session with a talk on relations between pipeline companies and landholders.

The four parallel afternoon sessions will offer attendants a wide choice of subjects, including gas processing, compressor stations, corrosion, revising the code for pressure piping, underground storage, gas measurement, dispatching and communications, and pipeline construction and maintenance.

1952 rate filings totaled $159 million, FPC reports

The mounting wave of gas rate increases takes the play away from the impressive dollar volume of natural gas pipeline construction certificates in the Federal Power Commission's 1952 annual report, recently published.

"Most significant phase of the recent rapid growth" is the way the commission describes the batch of rate filings, which in the single year aggregated $159.5 million, dwarfing the 1951 figure of $22.3 million.

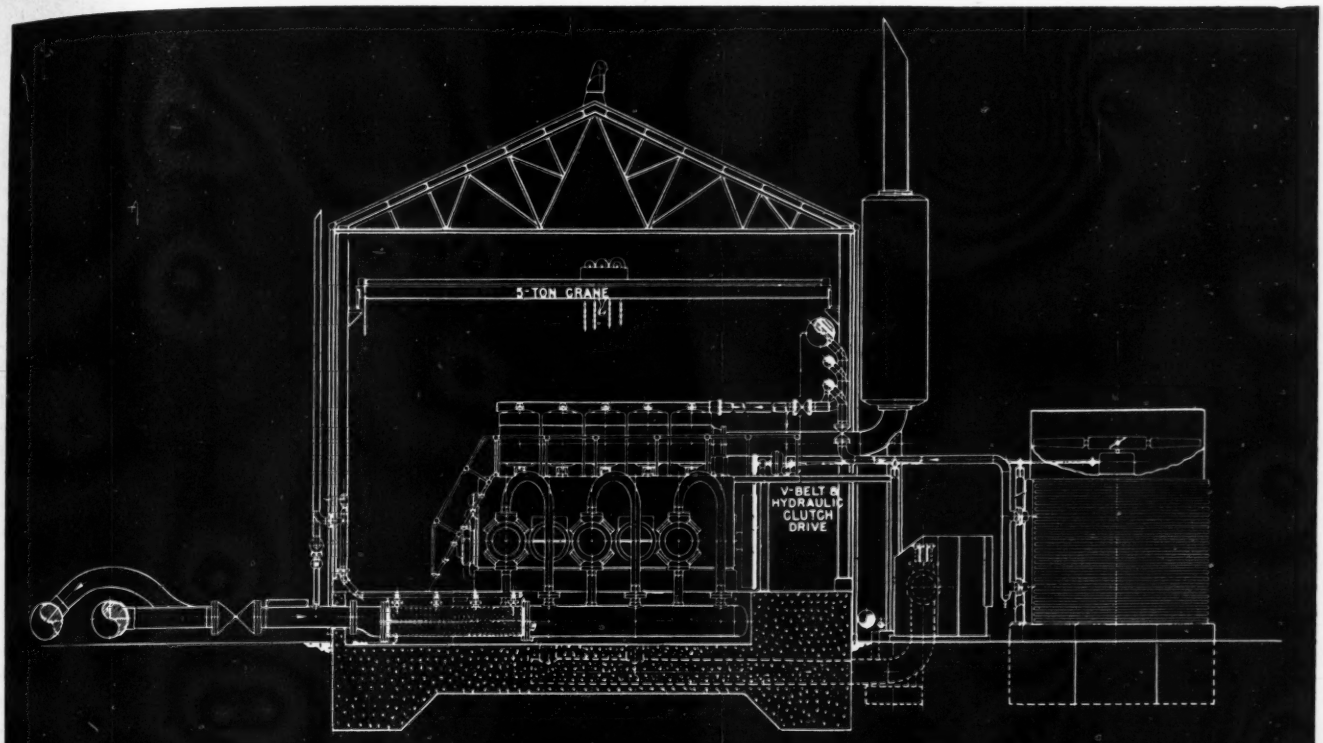
Pipeline construction certifications added up to a $322 million bill, covering 3378 miles of line and 539,510 hp for compression. This activity brought the totals for the decade beginning in February 1942 and ending in June 1952 to 863 certificates involving $3165 million, 204% more than total gas plant investment in 1938.

Colorado Interstate files proposals for two lines

Colorado Interstate Gas Co., Colorado Springs, has filed two applications with the Federal Power Commission, proposing the construction of natural gas transmission facilities in Colorado, Wyoming, Texas, Oklahoma, and Kansas, with a combined estimated cost of $43,155,249.

In one of the applications, the company proposes to construct a 365-mile, 22-in. line extending to Denver from a connection near Green River, Wyo. with the transmission system proposed by Pacific Northwest Pipeline Corp. This project, to cost about $23,298,653, would include a 5500-hp compressor station at Green River, and metering and regulating facilities. The company plans to purchase an average of 100 MMcf of gas per day from Pacific Northwest.

In the other application, Colorado Interstate proposes construction of 49 miles of 20-in. line and a total of 24,860 hp in compressor capacity at new and existing stations. This program, in Colorado, Oklahoma



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Pritchard-Built Unitized Gas Compressor Station

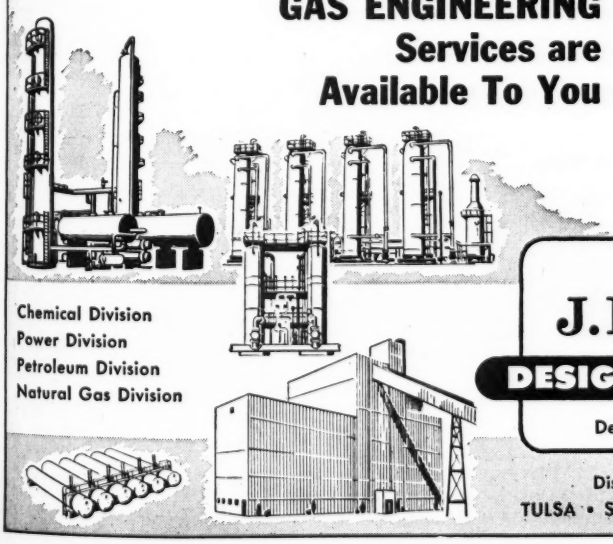
The Unitized gas compressor station shown above in cross section, is Pritchard's answer to the Natural Gas Industry's demand for increased efficiency and flexibility at lower cost per compression horsepower.

In this design, each engine compressor unit is made as nearly an independent unit as possible, with its own radiator-type jacket water cooler, oil to gas cooler and water circulating pump. As the line load varies, independent units may be added to or removed from service at will.

You are invited to make use of Pritchard's diversified experience in the Gas Engineering field in the design, engineering and construction of *modern* compressor stations or other facilities.

These Pritchard GAS ENGINEERING Services are Available To You

- Compressor stations and additions
- Pressure maintenance units
- Natural Gas Dehydration
- Desulphurization, amine type
- LP-Gas Installations
- Conditioning and treating
- Cooling and heat transfer
- Removal of liquids and dust
- Storage of Natural Gas on solid adsorbents



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Natural Gas Division

Write for Bulletin No. 61.92.001

NATIONAL CONSTRUCTORS ASSOCIATION — OIL STEEL CHEMICAL — MEMBER

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Texas, and Kansas, is estimated to cost $19,856,596. The company said that the project would increase the sales capacity of its transmission system initially by 82.5 MMcf of gas per day, and would help it meet the expanding demands of resale customers and important industrial establishments.

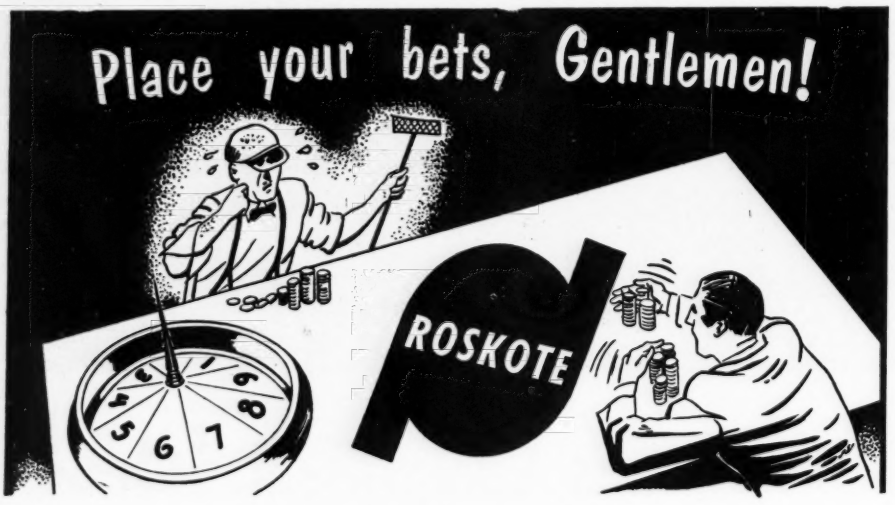
Pipeline engineers attend fourth annual short course

More than 100 engineers affiliated with the pipelining industry attended the fourth annual short course for pipeliners, held in Tulsa, March 4-6. The short course is sponsored by the Tulsa section of the National Assn. of Corrosion Engineers. The subject of the conference covered "practical control of pipeline corrosion." The course was designed to acquaint the pipeline field men with the corrosion mitigation problem, its cost and possible solutions.

W. A. Hutchison, Sinclair Pipeline Co., was chairman of the conference. Other members of the planning committee were Hugh A. Brady, Pipeline Anode Corp.; T. D. Williamson Jr., T. D. Williamson Inc.; Jim Bell, Service Pipeline Co.; Ed Bartolina, Moorlane Co.; and Mel Maddox, Pittsburgh Coke & Chemical Co.

The instructors in the course were F. M. Cloninger, Texas Pipeline Co.; Y. W. Titterington, Pipe Line Anode Corp.; F. M. Hieronymus, Barrett Div., Allied Chemical & Dye Corp.; Marshall Parker, Cormit Engineering Co.; Lancy F. Heverly, Great Lakes Pipe Line Co.; T. L. Canfield, Consolidated Gas Utilities; and T. M. Ragland, Phillips Petroleum Co. Carl Feldman, Sinclair Pipeline Co., gave the welcoming address. Subjects covered were fundamentals of corrosion; purpose and techniques of pipeline coating; pipeline insulation; the corrosion survey; corrosion mitigation with expendable anodes; rectifiers and cathodic protection; instruments for cathodic protection work.

Field demonstrations were held on the last day, with a number of the instructors also presenting demonstrations illustrating points that had been brought out in the lectures. The closing session of the conference was given over to a question and answer period.



...On ROSKOTE, of course — that's the one safe bet for complete pipe protection.

Roskote is applied *cold*. That means money saved by elimination of kettles and man-hours by faster operation and reduced hazards.

Roskote is fast drying. It dries to the touch in 20 minutes and is ready for backfill in an hour. That means money saved by speeding pipeline progress.

Roskote is ready to apply — by brush or spray — and bonds firmly to bare pipe or previous coatings. That's money saved by elimination of priming coat and field mixing or thinning.

Roskote retains its tough flexible film, without brittleness or sag through a temperature range of −40° to 375° F. It provides an electrical resistivity of 20 megohms per square foot. It is resistant to acid, alkali, salt and moisture.

Roskote is specified by more than 80 utilities and pipeline companies for coating pipelines, "hot spots", joints, road crossings, valves, meters, drips; for patching and for waterproofing concrete regulator pits.

For complete information, technical data and free samples of Roskote and Royston Glas-Wrap write:

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Northwest refuses to bow out as hearings drag on

As spring made its debut, the three principals and one lesser factor in the legal fracas which will decide who is to serve the Pacific Northwest were still deadlocked in Washington hearings before the Federal Power Commission.

No significant gains had been registered by Pacific Northwest Pipeline Co., the firm which would take gas from San Juan basin in New Mexico; Westcoast Transmission Co., the company which holds a Canadian permit to pipe gas from Peace river field in northwest Alberta; Northwest Natural Gas Co., which is still attempting to get the nod for its plan to tap the Pincher creek area in southwestern Alberta (even though it has no Canadian permit); or Trans-Northwest Gas Co., which wants to take Westcoast's gas this side of the border for transport through eastern Washington and Idaho.

So far, the latter three were reportedly ganging up on Pacific Northwest in an attempt to prove that withdrawal of reserves from San Juan would jeopardize Californians, who are dependent for a fair share of their gas supply from El Paso Natural Gas Co.'s line which taps the same region. With Pacific out of the picture, they could start sniping at each other. In such an event Westcoast would then appear to have the inside track.

In fact, there was some talk that Northwest Natural was about ready to pull up stakes, although this was strongly denied in subsequent hearings. George D. Horning Jr., attorney for Trans-Canada Pipe Lines Ltd., which is hoping to pipe some Alberta gas to eastern Canada, demanded that Northwest declare itself on rumors that it intended to drop the project in favor of one that would be competitive with Trans-Canada's. Northwest's Arthur C. Logan said his firm would not withdraw, but offered no clarification of the report that it intended to take gas eastward.

The Toronto *Financial Post* said Northwest officials had been in Ottawa, negotia

How do your equipment costs compare?

T-35 Back Hoe

Owning and operating costs:

Initial investment ----$9580.00*
(complete with GMC 6x6)

AVERAGE COST PER HOUR

A. Fixed owner costs-----$1.22
(Depreciation, interest, insurance, taxes, etc.)

B. Operating costs ------$ .50
(oil, gas, grease)

C. Maintenance and repair costs ----------$ .13
(including tires, cable, etc.)

TOTAL----$1.85

*NOTE: Above figures include average costs for both truck and Bantam, based on mounted hoe unit (20" bucket) with cwts., FOB Waverly, Iowa. (Subject to change.)

Chances are your present budget can be cut in half with T-35 Bantams®!

If you've been handling your pipeline work with *big* expensive equipment (or the usual "spread" of trenchers, high-lifts, dozers, etc.), you're in for a real surprise, when you see the *new* Bantam T-35 Back Hoe in action. Because the T-35 not only lets you handle high-speed trenching, pipe placement and backfilling with ONE machine . . . it does *all* these jobs at the *LOWEST net cost PER HOUR in the industry!* (Based on actual owner records—see average hourly costs above).

Add to these advantages, the T-35's *new remote* control . . . *fast job-to-job mobility* . . . 8 fast-change attachments . . . and you have a cost-saving combination that can't be equalled for handling emergency leak repairs, miscellaneous pipeline trenching, maintenance chores, compressor station work, etc.

See the T-35 Bantam in action *NOW*. Your nearby Bantam Distributor will gladly demonstrate the T-35's versatility on any job you wish, without obligation. A request on your letterhead will start a Bantam your way in a hurry . . . ACT TODAY!

SB-H-22

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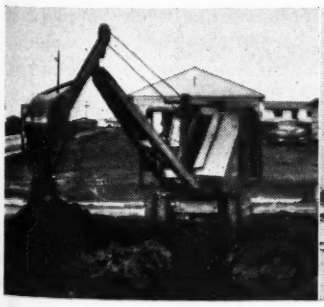
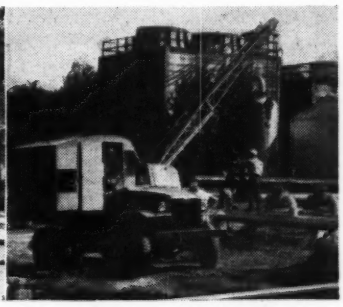


BACK HOE digs over 100' of 5' ditch per hr. with full range of bucket sizes. Cuts clean, straight trench to maximum 14' depth.

CRANE ADAPTOR quickly converts your Back Hoe, for fast unloading and placing of pipe, without changing hoe boom!

BACKFILL BLADE easily attached in 5 to 10 minutes, for fast backfilling. Parallel linkage blade also available for long-run jobs.



6-TON CRANE BOOM (optional 25' to 50' lengths) interchanges with hoe boom on the job, where longer reach is needed.

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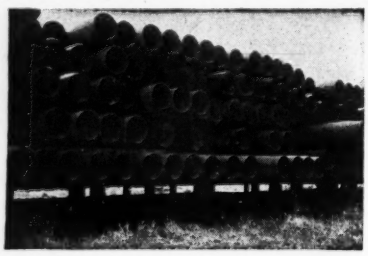
FIRST plant to establish electrical holiday detection for the entire surface of every length of your coated and wrapped pipe. This holiday detection permits the repair of all holidays, before your pipe passes final inspection.



FIRST plant to build storage skidways far enough above ground so that spattering of rain, snow, and mud does not cause ground corrosion on the underside of your pipe. This means better pipe protection of your pipe while in storage.

FIRST plant to build several primer drying areas, each over 100 feet in length, to properly age the primer before the hot enamel coating is applied. High velocity warm air is circulated to control primer drying time which assures maximum bond of the coating and wrapping to the pipe.

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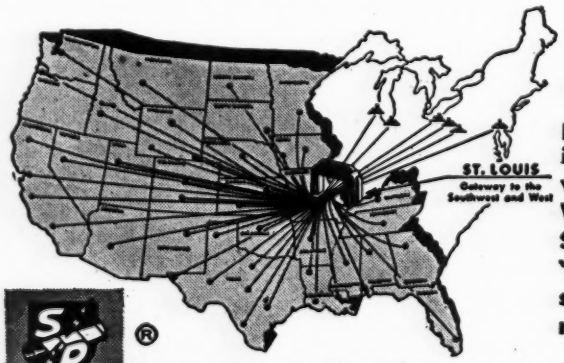

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ing for a line to serve Minneapolis, Detroit, Chicago, and Toronto.

In Canada, Alberta's Premier E. C. Manning was quoted as saying it was "most urgent" that an adequate market for gas export be assured as soon as possible. The number of capped wells and the amount of money now tied up in the industry is having a detrimental effect on exploration for gas and oil, he said.

Northwest, incidentally, hopes to get another hearing next month before Canadian officials on its application for an export permit.

New production company formed by Houston Natural

The formation and chartering of the Houston Natural Gas Production Co. as a wholly-owned subsidiary of the Houston (Texas) Natural Gas Corp., has been announced by President Frank C. Smith. The production company proposes to undertake a program of general exploration. Its plans provide for active participation in oil and gas development, as well as the acquisition of substantial gas reserves.

Dr. Boatright

Dr. Byron B. Boatright, consulting petroleum and natural gas engineer, has been elected vice president and general manager of the production company.

Huge natural gas system proposed by Houston firm

As *GAS* went to press, the newly formed Houston Texas Gas & Oil Co., headed by independent operator J. O. Mack of Houston, had still not laid its proposal before FPC for construction of a 1500-mile gas line from southern Texas and Louisiana to the north. The two lines to converge in northern Louisiana and extend north in two parallel 30-in. lines, would serve Detroit, Chicago, Philadelphia, several Ohio cities, St. Louis, and intermediate points.

The proposed line would have an initial capacity of 900 MMcf per day. Believed to be the largest system ever proposed, it would cost about $300 million.

"We have lined up the gas supplies; we have arranged for financing, and we have marketing commitments in the cities to be served," Mr. Mack stated in announcing the plan. "As of now, these cities are getting only about 50% of the natural gas they need."

The system would gather about 450 MMcf of gas daily in Texas and a similar amount from Louisiana, about 350 MMcf of the Louisiana gas to come from the tidelands

south and east of New Orleans with another 100 MMcf to be picked up in northern Louisiana.

Northeastern rate allowed; bonded increases effected

With backlogged rate increase applications before FPC reaching their five-month waiting period in increasing numbers, the commission has recently freed four suspended increases and lifted suspension on a fifth.

The one which will take effect without strings is the proposed $749,000 annual boost sought late in 1951 by Northeastern Gas Transmission Co., Springfield, Mass. The commission has decided that because of the "particular facts constituting Northeastern's developmental period," the New England supplier may have its full increase on a permanent basis, regardless of whether its supplier, Tennessee Gas, is permitted its own rate increase in whole or in part.

Northeastern's proposed increase had become effective under bond April 1, 1952, and FPC had reopened hearings on it last January. Now Northeastern may keep all monies collected under bond the past year, and effect the increase on a permanent basis.

Companies included in the four cases in which suspended increases were allowed to take effect under bond were Atlantic Seaboard Corp., Virginia Gas Transmission Corp., and Commonwealth Natural, all subsidiaries of Columbia Gas System; Alabama-Tennessee Natural Gas Co. and Hope Natural; and two other Columbia companies, Central Kentucky Natural and United Fuel.

FPC ponders Texas Eastern ability to supply Algonquin

FPC was to have begun oral argument late last month on a motion filed by Tennessee Gas Transmission Co., Houston, and Northeastern Gas Transmission Co., Springfield, Mass., requesting the commission to direct Texas Eastern Transmission Corp., Shreveport, to submit evidence that it possesses an adequate gas supply to serve Algonquin Gas Transmission Co., Boston, in addition to its existing customers. Hearings are now in progress on the competitive applications of Algonquin and Northeastern for service in New England.

Mississippi court reverses self, voids privilege tax

Death of a justice of the Mississippi supreme court has brought a reversal in an earlier decision, causing the court to declare unconstitutional a state privilege tax (*GAS*, January 1953, p. 112) which would have levied upon 11 pipeline companies a premium for laying their interstate gas line through the state.

Justice Fred Lotterhos, who succeeded the late Justice Julian Alexander on the state bench, swung the vote from 5-4 favoring up-

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holding of the tax to a similar margin invalidating it. Justice Alexander had voted for the tax.

Directly involved in the test case was Trunkline Gas Co., which filed suit in 1952 on behalf of the 11 companies. A lower court verdict holding for the companies was returned Sept. 18, but this was upset by the supreme court in December.

FPC revokes Chicago's liquefaction certificate

An aging piece of unfinished business was cleared off the records recently when FPC revoked, at the company's request, a 3½-year-old certificate providing for the construction of a liquefaction and storage plant by Chicago District Pipeline Co.

The Peoples Gas Light & Coke Co. affiliate was determinedly searching for a means of boosting peak deliveries to the utility in 1949 when the job was approved. Subsequent exploration by the Peoples subsidiaries, however, proved the potentialities of a water sand storage project at Herscher, Ill., which is now under construction by the recently formed Natural Gas Storage Co. of Illinois. Consequently, the Chicago District scheme was abandoned.

The 1949 certificate authorized the building of a $6 million plant to store 400 MMcf per day, liquefying 4 MMcf per day and returning to the transmission system 6 MMcf per hour during peaks. (For a complete story on how the plant would have operated, see *GAS* for October 1949, pp. 92 et seq.)

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Digging into the hard facts about the PLICO Pipeline Insulation System *now* can save you from digging into the hard ground later on, because Plico-insulated pipelines *stay* insulated. The Plico System is dual insurance against cathodic-protection "ground-outs."

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- PLICO Insulating Clamps are precision manufactured to fit your carrier line and reduce coating distortion. Rugged construction, with hard Neoprene liner, withstands severe abuse.

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A few choice areas still available for distributors

Notes

The Wisconsin Senate passed a bill and sent it to the assembly last month which would permit a foreign pipeline or railroad corporation to own more than 640 acres, the present limit, of land in the state. This would clear the way for any lines from west to east in Canada to enter Wisconsin. Trans-Canada Pipe Lines Ltd. has applied for such a line although its original plan did not call for such an entry into the United States. It is rumored that Northwest Natural Gas Co. also has some similar proposals.

Shipment of 42,000 tons of pipe being delivered to Southern Natural Gas Co.'s south Louisiana project between March 6 and April 22 will set a new record for the Port of Houston. The 40-ft lengths of 20-in. pipe for 220 miles of line is being produced by A. O. Smith Corp. at its Houston plant and trucked to the Houston canal, where it is loaded on barges which take it as near as feasible to its ultimate destination. When the job is completed it will be the largest tonnage of any material which the Port of Houston has handled in such a comparatively short time.

FPC has begun an investigation in connection with purchases of natural gas by Texas Gas Transmission Corp., Owensboro, Ky., from two wholly-owned subsidiaries, Louisiana Natural Gas Corp. and Texas Northern Gas Corp. The investigation has been consolidated with proceedings involving a suspended $10.5 million rate increase proposed by Texas Gas. In instituting the investigation the commission said, "it appears that the rates . . . may be unjust, unreasonable, unduly discriminatory, or preferential."

The Sawyer-Jensen-Ross Co., Tulsa, designers of the Shortstir side entering mixer for pipeline, refinery and process industry heavy-duty mixing, have announced appointment of two firms as representatives for the mixer. Morvin Thomas of the Morvin Thomas Co., Tulsa, has been named representative for the mixers in the Oklahoma, Texas panhandle, southern Kansas, and western Arkansas areas. Peddlers Inc., pipeline equipment company of Houston, will be exclusive representatives for the mixer in Mississippi, southern Arkansas, Louisiana, and Texas, except for the panhandle.

The Iroquois Gas Corp., Buffalo, N. Y. has applied to FPC for authority to construct pipeline facilities in connection with development of the Aurora field near Aurora and Colden, N. Y., as a storage area for natural gas. It plans to develop the field to an esti-

On the Site:

coating and wrapping of underground storage bottles for Washington Gas Light Co.

THE WASHINGTON GAS LIGHT COMPANY installation is a combination of underground high pressure natural gas storage and propane-air. The steel bottles are laid out in blocks averaging 40 bottles, each block storing approximately one million feet of gas. The bottles are installed in the ground with a minimum of 3'6" of cover, after being coated and wrapped. Cathodic protection is also provided. This combination of measures provide positive protection against underground corrosive attack.

The steel bottles for the Washington Gas Light Company installation were coated and wrapped at the site with equipment specially developed for this type of work by Pipe Protection Service, Inc.

This equipment, as well as portable equipment for the coating and wrapping of pipe from ¾" diameter up, is available for operation at customers' railhead or storage sites.

Pipe Protection Service, Inc.

Elizabeth, New Jersey

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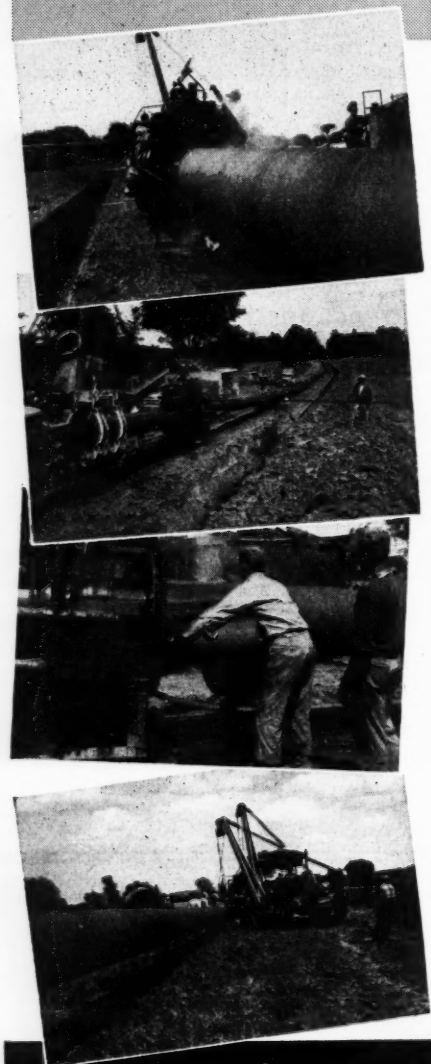
mated capacity of 1.6 billion cu ft and to construct about 6 miles of 16-in. pipeline to connect the storage area with its system. Total estimated cost of the project is $800,000.

Hearings on proposals for El Paso Natural Gas Co. to acquire natural gas pipeline facilities in Texas from West Texas Gas Co., Lubbock, were scheduled to begin the latter part of March. The hearing was being consolidated with proceedings involving a proposal by Southern Union Gas Co., Dallas, to increase deliveries in the Clovis, N. M., area and another application by El Paso for a partial abandonment of service to West Texas which supplies Southern Union. Purchase of the facilities by El Paso would eliminate West Texas as a "middle man" in the operation supplying Southern Union.

Southern Natural Gas Co., Birmingham, Ala., has filed a proposed $6,313,000 rate increase with FPC which would effect 52 utility customers in Mississippi, Alabama and Georgia. The proposed tariff, to be effective April 1, 1953, would increase Southern's rates by 4 cents per Mcf, or a total of 21.5% based on estimated sales for the 12 months ending March 31, 1954. The company cited high cost of its purchased gas and increases in wages and salaries of its personnel as factors making the increase necessary.

The S. D. DAY Company

Serving the Oil and Gas Industry



Pictured here are some typical applications of coating and wrapping products distributed by S. D. Day Company.

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*Available from Houston Warehouse Stock

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1973 WEST GRAY HOUSTON, TEXAS PHONE JU-2431

By vote of the stockholders at a meeting Feb. 16, 1953, the name Midwest Piping & Supply Co. Inc. has been changed to Midwest Piping Co. Inc. A. G. Stoughton, president and chairman of the board of directors of the St. Louis firm, said there has been no change in ownership, management, personnel, or activities of the company. The only change is the name to make it more accurately descriptive of the company's operations.

Southern Union Gas Co. has brought in a natural gas well which opens up a whole new area for development. The well is bringing in approximately 40 MMcf per day. It is located on Texas Co. leased land, about 10 miles north of Shiprock, N. M., on Navajo Indian land, and is the first to be brought in on the reservation.

Progress Reports

PLANNED

ATLANTIC SEABOARD CORP. and **VIRGINIA GAS TRANSMISSION CORP.**, Charleston, W. Va. Docket G-2062 for 5000-hp compressor station in Braxton county, W. Va.; 6600-hp station in Upshur county, W. Va.; and 5000-hp station in Shenandoah county, Va.; supercharging 3 units from 880 hp to 1100 hp and installation of one 1100-hp unit at existing station in Hardy county, W. Va.

CAROLINA NATURAL GAS CORP., Charlotte, N. C. Docket G-1956 for 40 miles of line to connect with Transco line near Kings Mountain, N. C., extending to Rock Hill, S. C., with laterals to four South Carolina points.

CENTRAL WEST UTILITY CO., Kansas City. Docket G-1682, four alternate plans to serve Clay county, Mo.

CHATTAHOOCHEE NATURAL GAS CO., Birmingham. Docket G-2066 for 70 miles of line in northwest Georgia, to connect with system of Southern Natural in Floyd county.

CHICAGO DISTRICT PIPELINE CO., Joliet, Ill. Docket G-2090 for 3.4 miles of 36-in., 31.2 miles of 30-in. and a .3 mile river crossing of 24-in. pipe in the Chicago area.

COLORADO INTERSTATE GAS CO., Colorado Springs. Dockets G-2120 and G-2121 for 365 mile, 22-in. line from Denver to connection with proposed Pacific Northwest Pipeline Corp. line at Green River, Wyo., with 5500-hp compressor station at Green River. Also 49 miles of 20-in. line and 24,860 hp in compressor capacity at new and existing stations in Colorado, Oklahoma, Texas and Kansas.

CONNECTICUT GAS CO., Berlin. Docket G-1954 for 3 short pipelines, totaling about miles, to extend from Connecticut Light & Power gas plants to Algonquin Gas Transmission Co. from plants at Waterbury, Willimantic and Putnam, Conn.

CUMBERLAND & ALLEGHENY GAS CO., Pittsburgh. Docket G-2059 for 17 miles of line in Garrett and Allegany counties, Md. and Mineral county, W. Va. and retirement of 75 hp in compressor units at station in Preston county, W. Va.

EAST OHIO GAS CO., Cleveland. A 125-mile 26-in. pipeline to serve Cleveland area from point just south of Toledo.

EL PASO NATURAL GAS CO. Docket G-210 for total of 1778 miles of line to include about 750 miles of 30-in. and 70 miles of 24-in. main line with related gathering lines, purification facilities and compressor plants totaling 157,00

hp to carry gas from Permian and San Juan basins.

FREDERICKSBURG NATURAL GAS CO., Fredericksburg, Va. Docket G-2041 for 28½ miles of 4¼-in. line and .72 mile of 3½-in. line connecting with Transco line, extending to Fredericksburg and area.

GLACIER GAS CO., Butte, Mont. Dockets G-1816, G-1817, G-1818 for 285 miles of 20-in. from northeast of Kalispell, Mont. to Spokane, Wash.; 91 miles of 8⅝-in. from Spokane to Lewiston, Idaho; 120 miles of 16-in. from Spokane to Hanford, Wash.; 130 miles of 12¾-in. from Spokane to south of Trail, B. C.

GULF INTERSTATE GAS CO., Houston. Docket G-2058 to construct 860 miles of 30-in. line from Point Rayne, La. to Boyd county, Ky., 229 miles lateral lines and five 8000-hp compressor stations.

HOME GAS CO., Pittsburgh. Docket G-2059 for 46.7-mile pipeline in Tioga and Broome counties, N. Y. and retirement of 180 hp in compressor units at a station in Broome county.

LONE STAR GAS CO., Dallas. Docket G-2005 for a 2640-hp compressor station and 5 miles of 12-in. line to New York City field reservoir, Clay county, Texas.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh. Docket G-2059 for 194 miles of line and retirement of 171 miles of line at points in Pennsylvania, West Virginia and Ohio; retirement of 440 hp in compressor units at station in Fayette county, Pa.

MISSOURI CENTRAL NATURAL GAS CO., Macon, Mo. Docket G-1509 for 25 miles of 6-in. from Moberly to Macon, Mo.

MISSOURI PUBLIC SERVICE CO., Warrensburg. Docket G-2057 for 109.3 miles of 8- and 10-in. main line and 27.1 miles of lateral lines. System to connect with Panhandle Eastern Pipeline Co. line at Franklin, Mo. and extend northwest.

MORGANFIELD NATURAL GAS CO., Morganfield, Ky. Docket G-1935 for a 31-mile, 4- and 6-in. line lateral to proposed Texas Gas Transmission Corp. line, to serve 6 Kentucky communities.

NATURAL GAS CO. OF W. VA., Pittsburgh. Docket G-2059 for 7.46 miles of line and retirement of same amount in Ohio.

NEW YORK STATE ELECTRIC & GAS CORP., Ithaca. Docket G-1999 for total of 49 miles of pipeline; 25 miles 10-in. from DeRuyther to Norwich, N. Y., 24 miles 8-in. from Norwich to Oneonta, N. Y.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh. Docket G-1980 (in part) for a 75-mile, 20-in. line from southern end of Driftwood field line to main dual line in Armstrong county, Pa. To be constructed in 1953.

NORTHERN NATURAL GAS CO., Omaha. Docket G-1918 for 400 miles of 24-in. pipe from the United States-Canadian border to a point near Minneapolis and two compressor stations with 5280 hp each.

NORTHERN NATURAL GAS CO., Omaha. Docket G-2009 for a 6.5 mile 30-in. loop line from Bushton, Kan. compressor station, northeasterly to a point in Ellsworth county; a 1.4 mile 8⅝-in. branch line from its Omaha branch line to a proposed regulating station near La Platte in Sarpy county, Nebr.; a 1320-hp addition to Hugoton, Kan. compressor station.

NORTHERN NATURAL GAS CO., Omaha. Docket G-2063 for 425 miles of mainline additions to connect with Permian Basin Pipe Line Co. system, and 62,400-hp in new and existing stations in Texas, Oklahoma, Kansas, Nebraska, Iowa, Minnesota and South Dakota. Also 475 miles of branch lines and additions to serve customers in Iowa, Minnesota, Nebraska and South Dakota.

NORTHWEST NATURAL GAS CO., New York. Docket G-996 for 1296 miles of 18-, 20-, 22-, and 24-in. line in Washington, Idaho, Oregon and British Columbia, together with laterals and four compressor stations aggregating 27,500 hp.

PROOF

HERE'S HOW TAPECOAT® HAS STOOD THE TEST OF TIME TO SOLVE CORROSION PROBLEMS

PROOF (Underground) — Inspection of TAPECOATED joints after 10 years of underground service showed no sign of corrosion when the TAPECOAT was removed.

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PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-2102 to build about 170 miles of 34-in. mainline loops and 15,000 hp in compressor capacity on line from Topock, Ariz. to a point near Milpitas, Calif.; and 8 miles of line between Milpitas and Irvington, Calif.

PACIFIC NORTHWEST PIPELINE CORP., Houston. Docket G-1429 for 1466 miles main line; 380 miles of spur and lateral lines; and 16 compressor stations totaling 104,420 hp, to extend from Ignacio, Colo., in the San Juan basin, to Bellingham, Wash. (Seattle area).

PERMIAN BASIN PIPELINE CO., Omaha. Docket G-1928 for 163 miles of line and 66,000 hp in compressor stations to carry gas from Upton county, Texas and Lea county, N. M. to connection with 24-in. El Paso Natural line to Dumas, Texas.

SOUTHERN CALIFORNIA GAS CO. and **SOUTHERN COUNTIES GAS CO.,** Los Angeles. Docket G-2104 to build about 73 miles of 30-in. mainline loops and 5280 hp in additional compressor capacity at Blythe on existing line extending from Blythe to Santa Fe Springs, Calif.

TENNESSEE GAS TRANSMISSION CO., Houston. Docket G-1969 for certificate to perform natural gas transmission service for Niagara Gas Transmission Ltd., Toronto, and Iroquois Gas Corp., Buffalo. To construct 574-mile, 30-in. line from Kinder, La. to join existing system; 130 miles of loop line; a 45-mile spur from near Buffalo to international border; submerged crossing of the Niagara river; 17,520 hp additional at existing compressor stations; 3 new stations; and 158 miles of lateral lines.

TEXAS ILLINOIS NATURAL GAS PIPELINE CO., Chicago. Docket G-1914 for six new compressor stations totaling 70,000 hp on its Texas to Illinois transmission line and installation of additional units totaling 10,000 hp at five existing stations. Also for construction of a suspension bridge across the Mississippi river and lateral lines to connect additional reserves to system.

Texas Eastern Transmission Corp. officially opened its new 14-story office building in downtown Shreveport, La., Feb. 28. Completely air conditioned, the Texas Eastern Building has about 200,000 sq ft of office space, more than half of which is used for general offices by Texas Eastern. The remainder is leased.

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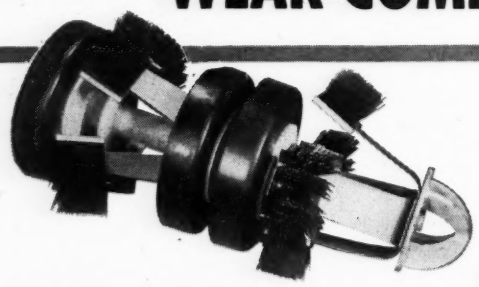

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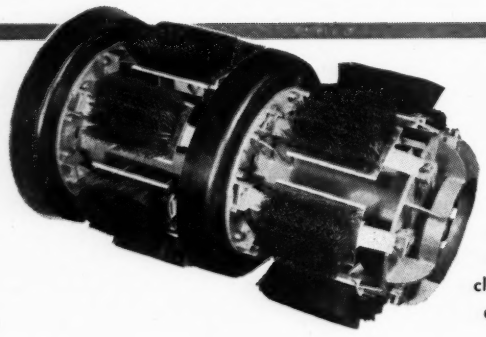

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TRANS-CANADA PIPE LINES LTD., for 2200-mile line from Alberta to major cities as far east as Montreal.

TRANS-NORTHWEST GAS INC., Spokane. Docket G-2111 for construction of pipeline system to serve markets in eastern Washington and northern Idaho, starting at international border near Osoyoos, B. C., south to Hanford, Wash., east to Spokane and Wallace, Idaho, north again from Spokane area to Trail, B. C.

UNITED FUEL GAS CO., Charleston. Docket G-2061 for 50.5 miles of pipeline from new 2640-hp compressor station at existing storage pool in Wood county to Lanham station in Putnam county, W. Va. Also acquisition of leaseholds and authority to drill wells, install well and field lines for proposed new storage pool.

UTAH NATURAL GAS CO., Salt Lake City. To build a 96-mile line, beginning with 18-in. pipe from fields in Carbon, Emery and Sanpete counties running northwest to a point near Provo and continuing with 16-in. pipe to a point near Salt Lake City; laterals, field and gathering lines, dehydration plants and appurtent facilities.

WESTCOAST TRANSMISSION CO. INC., Wilmington, Del., 349 miles, including 277 miles from Sumas, Wash. to Portland, Ore. with short branches to a number of cities in the two states and 72 miles of laterals and 13 measuring stations. To connect with 683 mile 24-in. line to be built by parent company, Westcoast Transmission Co. Ltd., from Peace river area of Alberta and B.C. Location survey under way.

UNDER WAY

ALGONQUIN GAS TRANSMISSION CO., Boston. Facilities including several laterals remain to be completed. Work held up pending further FPC hearings.

ARKANSAS-LOUISIANA GAS CO., Shreveport. Docket G-1979 for 6 miles of 12¾-in. line in Hot Spring county and a 7500-hp compressor station on the company's "Line S" between Waskom, Texas and Perla, Ark. Delta Engineering Corp. at work.

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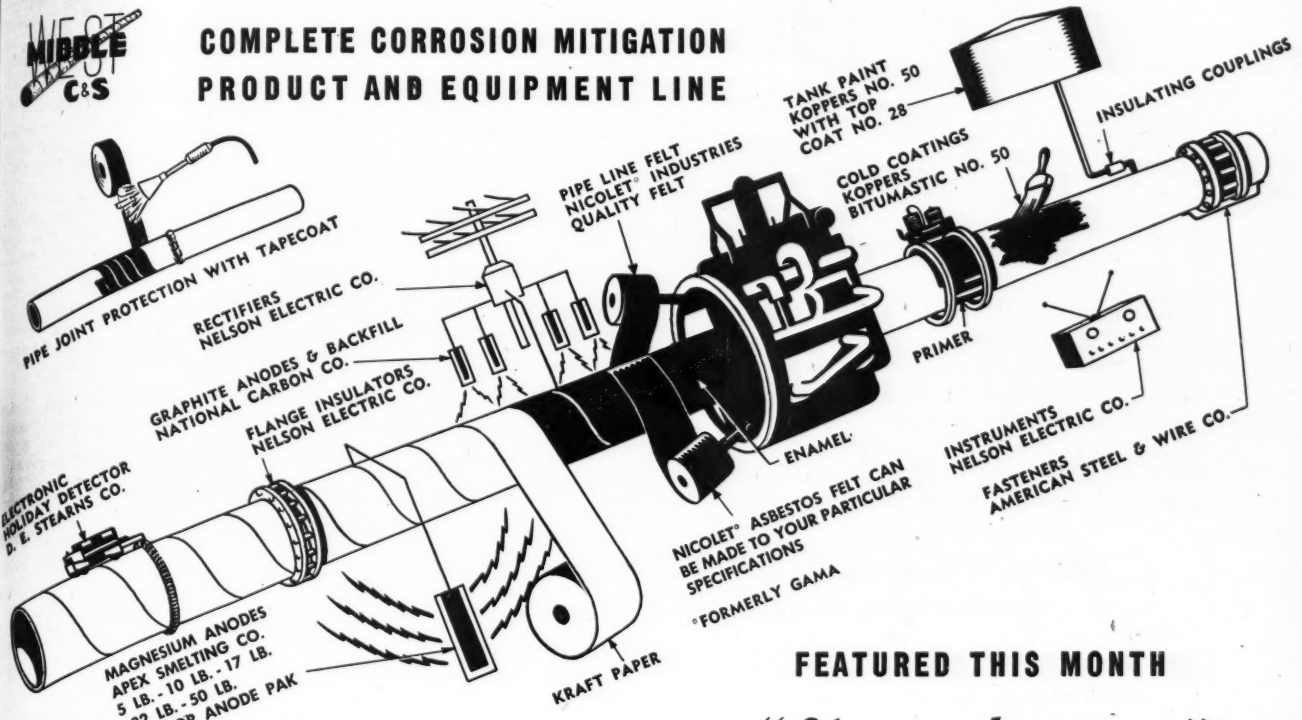
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STREET CITY ZONE STATE

CITIES SERVICE GAS CO., Oklahoma City. Docket G-2038 for installation of 11,400 hp compressor capacity—three 1600 hp units to be added to its Greensburg station, Kiowa county; six 1100 hp units in a new station in Harvey county, Kan. Expected to be complete Sept. 30, 1953.

EL PASO NATURAL GAS CO. Dockets G-1630, G-1631 for about 170 miles of 30-in. mainline loop on existing transmission system, and about 153,000 hp in mainline and booster compressor stations.

HOUSTON PIPE LINE CO. has Houston Contracting Co. at work on 40 miles of 16-in. line from Edna, Texas to the Tom O'Connor gas field.

NORTHERN NATURAL GAS CO., Omaha, has Reese Brothers Construction Co. at work on 140 miles of gathering lines in Kansas and Oklahoma. About 85% complete. Remainder to be completed by spring 1953.

NORTHERN NATURAL GAS CO., Omaha. Docket G-1618 for 213 miles of 26-in. loop lines in Texas, Oklahoma, Iowa, Kansas, Nebraska and Minnesota, and 100,160-hp additional compressor capacity. R. H. Fulton at work on 25 miles 26-in. loop south of Bushton, Kan. compressor station, and 23 miles 26-in. loop north of Beatrice, Neb. C. S. Foreman at work on 2000-ft Arkansas river crossing in Kansas.

OKLAHOMA NATURAL GAS CO., Tulsa. To build 50-mile 18-in. line from Sapulpa to Pryor, Okla. to serve chemical plant to be constructed by Deere & Co. and Grand River Dam Authority furnaces. Engineering Construction Co., Tulsa, to start work about April 20.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-1651 for 86.25 miles 34-in. loop and 19,540 hp addition on existing Topock-Milpitas line. Engineers Limited Pipeline Co. at work on loop construction. Bechtel Corp. at work at Hinkley and Kettelman compressor stations. Expect completion of project in summer 1953.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-1892 for 20 miles of 16-in. line from Burrell to a point near Easton, contract let to Alex Robertson Co. with completion scheduled for May 1; 15 miles of 20-in. pipe extending from Helm and joining the system's Topock-Milpitas line in Fresno county; and for 15.5 miles of 12¾-in. in Madera county parallel to the existing Madera-Livingston line, scheduled for construction in 1953-54.

SOUTHERN CALIFORNIA GAS CO. and **SOUTHERN COUNTIES GAS CO.**, Los Angeles. Docket G-1718 for about 20 miles of 30-in. loop line east from Whitewater, Calif., and 13,520-hp additions to compressor facilities on existing line from California-Arizona boundary to Los Angeles. Line construction nearly complete; compressors to be completed July 15.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1907. Total project approved including 792 miles of line and 14,200-hp compressor capacity—about 522 miles of looping on existing system with addition of 9800 hp to existing stations; about 270 miles in new lines and a new 4400-hp compressor station. Work underway, about 135 miles completed. Miscellaneous size lines for gathering system, 384 miles to be laid south of Gwinville, Miss.; 5400-hp compressor at Gwinville; and 3300-hp compressor station at Estopinal, La. Brown & Root Inc. and Houston Contracting Co. at work with completion expected Oct. 1, 1953.

TENNESSEE GAS TRANSMISSION CO., Houston. To build 369 miles of line in 1953, enlarge two compressor stations and complete one new station. Of the total pipe, 173 miles will be 30-in. loop; 64 miles, 24-in. loop; and 132 miles of 26-in. line from Mercer, Pa. to Hebron storage field in Potter county, Pa. Addition of 2640 hp will be made at Carrollton, Ohio, station, 2200 hp at Mercer, Pa., and a new 6600-hp station will be built at Kinder, La.

TEXAS GAS TRANSMISSION CORP., Owensboro. Docket G-1847 for 408 miles of 26-in. loop line in six sections. H. C. Price has 4 miles remaining to be completed this spring.

TEXAS EASTERN TRANSMISSION CORP. Shreveport. Docket G-1947 for 315 miles of 24-in. line from a connection with Wilcox Trend

line at Provident City, Texas, to connection with existing system near Castor, La. Contractors at work: Associated Pipeline Contractors, 75 miles from Lavaca county to Waller county, Texas; Anderson Bros. Corp., 82 miles from Waller county to Polk county, Texas; Williams Brothers Co., 71.4 miles from Polk county to Shelby county, Texas; Pentzien Inc., four river crossings. Scheduled completion date is May 20.

WILCOX TREND GATHERING SYSTEM INC., Dallas. Docket G-1959 for one 2200-hp compressor station; 157 miles of line from McMullen county to connection with Texas Eastern near Provident City, Texas; and about 60 miles of laterals. H. B. Zachry Co. is trunkline contractor; Altgelt Construction Co. at work on gathering system; Brown & Root Inc. to build compressor station. Completion scheduled for May 20.

UNITED NATURAL GAS CO., Oil City, Pa. Docket G-1854 for 15.1 miles 12-in line and replacement of 6.5 miles 8-in. line in Venango county, Pa. delayed by pipe deliveries. Expected to be completed by June 1, 1953.

PENDING CONSTRUCTION

EAST TENNESSEE NATURAL GAS CO., Knoxville. Docket G-1336 for a 100-mile, 16-in. line from near Knoxville to Kingsport, Tenn. with about 58 miles of various sized lateral lines.

IOWA-ILLINOIS GAS & ELECTRIC CO., Davenport. Docket G-2012 for 22 miles of line to connect with Natural Gas Pipeline Co. of America's system in Mahaska county and extend to a point in Ottumwa county, Iowa.

KANSAS NEBRASKA NATURAL GAS CO., Hastings. Docket G-1857. To build 167 miles of line northwest and northeast of Neligh, Neb.; about 51 miles of transmission line in Kansas and Nebraska; and about 111 miles of gathering lines in Kansas, Nebraska, and Oklahoma. Work expected to start in spring.

NEVADA NATURAL GAS PIPE LINE CO., Las Vegas. Docket G-1888 for 120 miles of 12¾-in. line from Topock, Ariz. to Las Vegas and Henderson areas. Construction scheduled to start about July 1, 1953. H. G. Laub, pres., 7th & B St., Victorville, Calif.

OHIO FUEL GAS CO., Columbus. Docket G-2013 and G-1985 for five gas pools to be converted to storage; one in Ashland and Richland counties to be added to Weaver storage area; formation of the new Holmes storage area with four pools in Holmes, Wayne and Ashland counties; 34.5 miles of 20-in. line to bring gas in; and a 6000 hp compressor station. Also 97 miles of line to connect areas with existing transmission facilities.

APPROVED

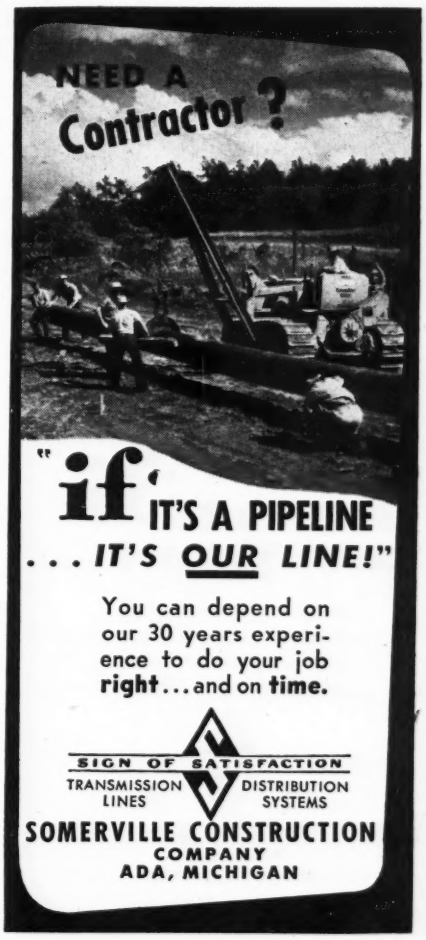
SOUTH CAROLINA NATURAL GAS CO., Columbia, S. C. Docket G-1961 for a 160-mile pipeline in Aiken, Lexington, Richland, Orangeburg, Dorchester, Charleston, and Berkeley counties, S. C.

SOUTH GEORGIA NATURAL GAS CO., Birmingham. Docket G-1915 for a 335-mile line to serve communities in southwest Georgia and northern Florida. Main trunk would connect with system of Southern Natural Gas Co. in Lee county, Ala., and extend to Albany, Ga., with a branch to Tallahassee, Fla.

CONTRACTS LET

NEW YORK STATE NATURAL GAS CORP., Pittsburgh, to Williams-Austin Co. for 10 miles of 20-in. line in Driftwood, Pa. area. To Pipe Line Construction & Drilling Co. for 19 miles of 20-in. in northern Pennsylvania. Jobs expected to start May 1.

NIAGARA MOHAWK POWER CO., Syracuse, N. Y., to Williams-Austin Co. for 52 miles of 10-in. line from Fulton to Watertown, N. Y. Expect to start May 1.



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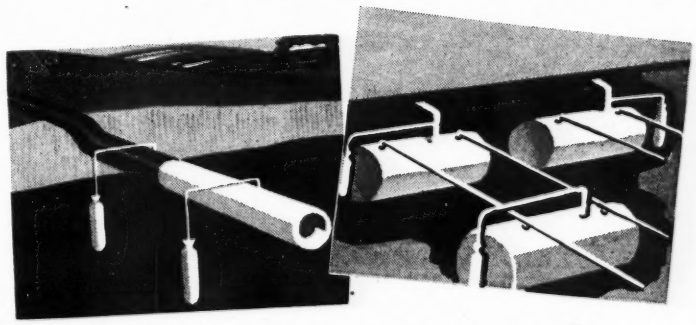

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Straight from the Kettle on PIPE PROTECTION

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By Boyd Mayes

• An oldtimer in pipelining dropped in the office the other day to pay his sympathies . . . said he'd just heard we were broke; that we may be folding up the business any day now. His story wouldn't have been nearly as funny without tying it in with one a customer of ours had heard the day before. The story he'd heard was that we'd made so much money that we didn't have to work . . . that we weren't interested in our business any more, and that we wouldn't walk around the corner to bid on a job. Now, to our way of figuring, its not only very embarrassing to wake up one morning rich and the next morning broke, but it's darned confusing to the trade. We've been too busy cleaning, coating and wrapping pipe to stop and count our money the past few weeks but we do know, for sure, that we've got more than a million dollars invested in one of the most modern plants in the business, permanently fastened down on a 56-acre yard that's pretty well stacked with customers' pipe, and operated by around 80 skilled craftsmen who get their paychecks on the dot. We've got enough to turn out any size pipe coating or reconditioning job, and we think that's about all the pipe line industry is terribly concerned about!

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New Products

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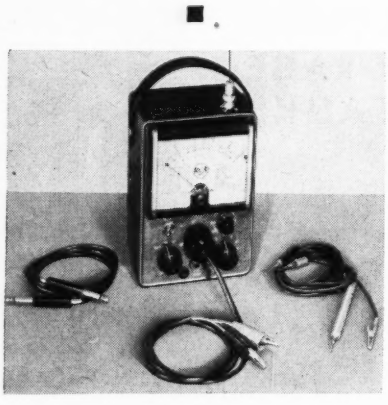
19 Micro-Talkie

Now in mass production is a hand-sized Handie Micro-Talkie transmitter designed to operate in the 152-174 mc frequency band. The compact unit, weighing only 1 lb, 13 oz, has a power output of 20 to 40 milliwatts and a tested optimum range up to five miles.

The transmitter, with self-contained dry batteries and microphone, is contained within a sturdy, seam-welded housing finished with a gray automotive type baked enamel. A rigid, chrome plated loop antenna doubles as the carrying handle. Eight sub-miniature tube stages with "printed" associated circuitry are used. In operation, to transmit it is only necessary to press a button on the side of the unit. With the transmitter operated on the practical-duty cycle of 15 seconds out of each five minutes, "A" battery life is one work week with the "B" batteries lasting two and a half weeks.

Motorola Inc.

■



20 Portable Meter

The means for making all the electrical measurement necessary to install and service two-way radio communications is contained in a new portable multi-range voltmeter and milliammeter. The new general purpose test meter will measure current, voltage, and comparative radiated power. Several related functions can be checked with a single arrangement of test leads, providing the equipment has built-in metering sockets or proper point-to-point checking facilities.

The equipment is provided with a short "sniffer" antenna to enable the meter to measure relative radiated power in the immediate field of a transmitting antenna. A large, easy-to-read meter face simplifies readings and assures greater accuracy. It contains a meter movement with a sensitivity of 50 micro-amperes for full-scale deflection and its accuracy is plus or minus 4% of full scale on all voltage and current scales.

RCA Victor Division

■

21 Repair Clamp

Featuring a pilot-pin sighting device with neoprene seal, the Smith+Clamp is now available for repairing all pipeline rust-hole or pit-hole leaks. Lower bolting pressure is required since the point of the neoprene cone is directly centered over the leak. This relieves much of the danger of cave-ins on corrosion-thinned pipe walls.

Pressures higher than 2000 psi can be effectively and safely controlled with the aid of this light weight clamp.

Weld plates especially designed to fit over the clamp can be welded to the pipe without disturbing the clamp. This can be done without disrupting service.

Pipe Line Development Co.

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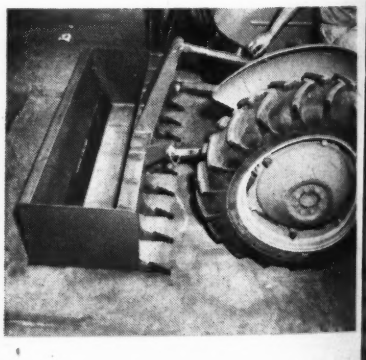


22 McGee Scraper

A new McGee Scraper, Model 5021, has been designed for use on Ferguson and Fordson tractors.

Three new features are an improved hydraulic upper link; raised top hook-up for

longer life to the scraper, hydraulic upper link and tractor; and a choice of either six or nine scarifying teeth.

With the exclusive self-contained hydraulic upper link, the operator can adjust the tilt of the scraper for scraping, backfilling, scarifying, or scarifying and scraping—changing from one operation to another—without getting off the tractor.

Bucket capacity is approximately ¾ yd. Both cutting and adjustable backfilling blades are 5 ft 6 in. wide.

Earth Equipment Corp., distributor.

■

Trade Literature

23 Introduction to Microwave

A comprehensive 20-page booklet, "An Introduction to Microwave," is now available. It explains, with the assistance of many photographs, diagrams, and charts, just how microwave works and who can use it to advantage. There are many other topics covered, such as economic factors, reliability, simplicity, and planning of a microwave system. The RCA 960- and 2000-mc equipment features are also explained.

It describes how through multi-channel circuits "push button" control of unattended pipeline pump stations and equipment at remote points is possible.

Radio Corp. of America

■

24 Purifiers Folder

A folder entitled "End Dirt and Moisture Problems the Hi-eF Way" has just been published as a guide to practical applications of purifiers for cleaning up moisture, mist, dirt particles, and other entrained materials in pipelines and equipment. It describes the many uses of purifiers (mechanical separators) throughout the petroleum, chemical, and other industries.

Information is also given on the types of entrainment likely to be found in the various vapors and gases. Seven types of purifiers available to solve dirt and moisture problems are diagrammed.

J. D. Anderson Co.

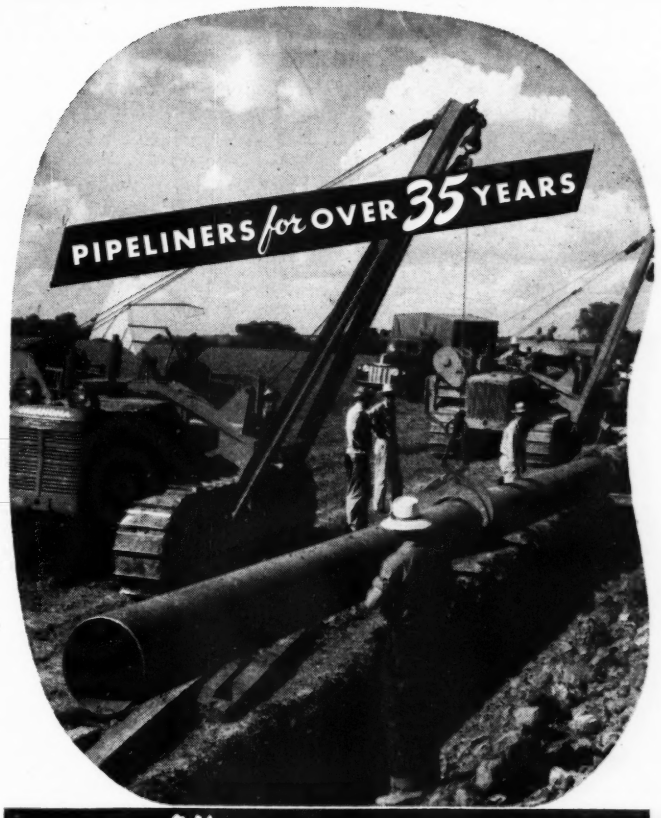
■

25 Trencher Bulletin

A four-page bulletin on the Cleveland Model 320 trencher has just been published by the Cleveland Trencher Co. Photographs showing the trencher in action under all types of job and weather conditions are included with a text briefly outlining advantages and special design features.

Complete dimensions and specifications, including a table of optional cutting widths, are also contained in the two-color folder.

Cleveland Trencher Co.



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Pipeline People

WILLIAM G. MAGUIRE, formerly chairman of the board of directors, has been elected president of the Panhandle Eastern Pipe Line Co. His selection followed the resignation of EDWARD BUDDRUS. HY BYRD, president of Trunkline Gas Co., was elected vice president.

A. A. MacDonald
Motorola

E. Buddrus
Panhandle

Motorola has announced the appointment of L. HARRISS ROBINSON to the position of manager of the Washington, D. C., office of Communications and Electronics Inc. Other appointments include JOHN FUSSELL, who will fill the position vacated by Mr. Robinson as manager of Region 7, and ANGUS A. MACDONALD, who was made assistant chief engineer in charge of two-way radio development. Mr. Fussell was assistant regional manager, and Mr. MacDonald was formerly associated with Westinghouse Electric Corp.

E. O. Owens

Don L. Long

T. D. Williamson Inc. announced the appointment of E. O. OWENS and DON LONG as sales and service engineers. Owens has been employed in corrosion engineering and cathodic protection capacities since 1938. Mr. Long has been in the design and construction engineering field four years.

Southern Natural Gas Co. has promoted several of its engineers. GEN. P. H. TIMOTHY is now special projects engineer and working on a south Louisiana project. J. BLEDSOE JR. has been named assistant chief engineer for the firm, and FRED P. WHITAKER is office manager. Gas processing and transmission technician is the new title for JIM PHILLIPS. Mr. Phillips is serving in the pipeline department.